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R. P. LAMONT, Secretary

STANDARDS YEARBOOK

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GEORGE K. BURGESS, Director

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LETTER OF SUBMITTAL

DEPARTMENT OF COMMERCE,
BUREAU OF STANDARDS,
Washington, October 27, 1931.

SIR: I have the honor to submit herewith for publication the sixth issue of the Standards Yearbook.

In this publication there is presented a picture of the standardization movement in various fields of industry conducted by certain national and international agencies. The present volume contains outlines of the standardization activities and accomplishments of not only the Bureau of Standards and other agencies of the Federal Government and the States, counties, and municipalities, but also those of technical societies and trade associations.

Among the special features of the present yearbook is a series of articles contributed by experts in the several fields of communication. The articles are intended to give a panoramic view of the value of research as an aid to standardization, together with brief summaries of the accomplishments in the respective fields covered.

Special attention has been paid to the current standardization programs of American standardizing agencies, their accomplishments to date, with special reference to the year just past, without reproducing the information concerning their methods of appointing standardizing committees, authority bestowed upon these committees, and their functions and procedure, which can be found in previous editions of the Standards Yearbook. An attempt has been made in this issue to include in the outlines such methods as are employed by these agencies for making their standards and specifications effective throughout industry and to determine whether or not their requirements are being complied with.

The Standards Yearbook is proving of much value to manufacturers, industrial experts, and engineers, as well as to purchasing agents, both governmental and general.

Respectfully,

GEORGE K. BURGESS,
Director, Bureau of Standards.

Hon. R. P. LAMONT,
Secretary of Commerce.

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STANDARDS YEARBOOK, 1932

I. STANDARDIZATION IN COMMUNICATION—A SYMPOSIUM

INTRODUCTION

Standardized communication promotes human progress. Everyone has unique needs to add to the catalogue of human desires. Everyone has also unique means to meet such desires. Communication links the needs and the means. At the ends of every line of communication are the sender and receiver—a general to his army, a newspaper to its readers, a radio broadcast to the world, or a chat between two children. Contacting the two is the art of communication. Between them vast systems of sending and receiving assure accuracy, speed, convenience, adequacy, economy, and these systems are fast becoming automatic. Progress in the means of communication, therefore, speeds up human progress, for such progress conditions the growth rate of its civilization.

Language is a standard convention of symbols, written, spoken, or performed by gesture (Indian sign language or deaf-mute manuals). The art of printing is the multiplier and broadcaster of language in ink patterns called alphabets. Literature is the capital, equipment, and contents of such broadcasts. Written word is sent by rail, air mail, pigeons, or by printing telegraphy by wire or by radio post. Spoken word goes direct by wire or by radio across continents and oceans. Code signals with conventional meanings are primitively sent by drums, click of stones under water, beacon fires, smoke pulses, flags, lights, devices without end.

Communication is a bridge between minds or between nature and man. Waves of air or ether tell us all we know of the universe about us. Incoming starlight reports events among the stars. Each atom formed in interstellar space sends its quantum of cosmic ray reporting the fact. Star messages are deciphered through prism or grating, reaching the eye or the camera, photocell, or other device after traveling millions of years.

We use ether waves wherever light or radio serves us, for the two differ only in wave length. Pattern grooves on a disk become automatic transmitters. Photofilm becomes an automatic recorder and reproducer of light and sound messages from any source. Pattern light-point pulses of ever-varying size are the essential of television.

Communication as the bridge to and from the minds of men is thus built on air and ether waves. Air waves impinging on the ear meet tuned response mechanism. Such air waves are evoked by the thud of the jungle drum, the clang of the gong, the strokes of the cathedral carillon calling to prayer—by a thousand means of causing bodies to vibrate.

Standardization is essential because messages must reach millions and be correctly interpreted, the words or signs being standardized to the extent that they are intelligible at all. Telephones are standardized for transmission and reception. Standard highway stoplights broadcast warnings. But recent devices permit the car to turn the red light to the cross traffic by photocell or mechanical leverage. Red is an automatic broadcast, continuously safeguarding the lives of motorists at every crossroad.

The flow of information through countless channels of communication makes the whole world aware of events everywhere. Communication is making the world self-conscious. It quickens our racial life and enriches it. All lines of communication are continually alert with the transmission of the news. Day and night unceasing, the flow of the news! The epic of progress!

In unnumbered ways communication makes safe the travel of the world, makes wiser its people, integrates its interests and concerns, develops a racial consciousness not unlike in principle the central nervous system of man which keeps him informed of every sensation of the body. So, as transport carries the means of subsistence and enterprise communication on a racial scale carries facts, ideas, ideals from each to all and from all to each, a vast vehicle of mental and spiritual life of the world.

In our own day communication has developed so that its messages may travel automatically, continuously, with the speed of light, to the ends of the earth—with speech, signals, music, and movement, to inform, entertain, educate, and to coordinate and unify the thoughts and ideals of the human race, through standardized systems perfected for the purposes they serve.

STANDARDIZATION IN AERONAUTICAL COMMUNICATIONS

By Clarence M. Young, *Assistant Secretary of Commerce for Aeronautics*

Airmen flying over any portion of the Federal airways system which now covers a major portion of the Nation, constantly are receiving guidance and assistance from the communications system of the Aeronautics Branch of the Department of Commerce.

Their courses are outlined accurately by the rotating beacon lights and the beams of the radio range beacons. They are told by radio signals from marker beacons when to adjust their radio sets to receive the next radio range beacon as they near the limits of the beam they have been following. Weather information is furnished periodically by the airways communications stations working in conjunction with the automatic telegraph typewriter circuits. Intermediate landing fields, lighted and marked for ready identification from the air both day and night, are nearly always within a short distance of the airmen.

The communications system of the Aeronautics Branch is so standardized that it matters not where airmen may be flying, they always will receive the same type of information pertaining to air navigation. Hence, by familiarizing themselves with the communications procedure in operation on any one section of the Federal airways system, airmen hold the key to the methods employed by the

entire communications system of the Aeronautics Branch. That which follows may serve to illustrate this statement:

The airways beacon lights on the Federal airways rotate six times a minute and thereby show six flashes in that period. The beacon lights are located at standard intervals, 10 miles apart, and are established in series of 10 in 100-mile sections. The number of each beacon light on each 100-mile section is flashed in code by two red course lights placed on the tower platform. As the result of assistance rendered by the course lights, airmen need know only on which section they are flying to ascertain their approximate position along the airway. The red course lights, which signify the absence of landing facilities, are so installed that they point backward and forward along the course. Thus, airmen know in which direction they will find the next beacon light if the weather obscures it from vision. For day operations, a concrete arrow at the base of each beacon light tower points to the direction of the airway.

Beacon light towers at intermediate landing fields carry green course lights instead of red. In addition to the beacon and course lights, an intermediate field is identified at night by the presence of boundary, approach and obstruction lights and an illuminated wind-direction indicator. Standard boundary lights, installed at intervals of approximately 300 feet around the perimeter, outline the field. Green lights, installed in the boundary system, indicate the best approach to the landing area. Obstructions on or near the landing area are marked in all cases by red lights at the height of the obstructions to be cleared.

In daylight, an intermediate landing field is identified from the air by a chrome-yellow circle at the intersections of the runway center lines, with chrome-yellow panels 20 feet long and 2 feet wide extending from the outside circle along the runway center lines to indicate the best landing directions. The boundaries of the field are marked by chrome-yellow sheet-metal cones 30 inches in diameter and 24 inches in height, installed immediately below the boundary lights and attached to the boundary light standards. These markings and lights are standard characteristics of all intermediate landing fields established and maintained by the Aeronautics Branch of the Department of Commerce.

The radio range beacons, although of two types—aural and visual—are standardized in their methods of operation. Each type provides directional guidance by sending out signals that mark a course for 100 miles or more. These signals are received through earphones (for the aural beacon) and through an indicator on the instrument board for the visual type. One airway, at this writing, is being equipped with the visual type transmitters, thereby providing identical radiodirectional service of this particular type for aircraft using this airway.

When an aircraft nears the limit of the range-beacon course, the pilot is warned by signals from a radiomarker beacon so that he may adjust his radio set to receive the signals from the beacon ahead. The marker beacons are also equipped with radiotelephone transmission equipment.

Aeronautical weather information is gathered and transmitted in accordance with uniform practices. The automatic telegraph-type-

writer circuits first collect the data from Weather Bureau stations along the airways and at points about 200 miles left and right of the route. This material, together with the conditions prevailing at the automatic telegraph-typewriter station, is transmitted to the airways' radio-communications stations which assemble, edit, and then broadcast it by radiotelephone to aircraft in flight along the airway. The information broadcast includes the correct time, the condition of the weather, degree of visibility, velocity of the wind, temperature, barometer reading, and other information of importance. These broadcasts are made at regular intervals, in some cases hourly, and in others on half and quarter-hour schedules.

The position reporting of aircraft in flight over the airways is also conducted in accordance with uniform practices. When an airman leaves an airport and if he requests the position-reporting service, a message goes out over the automatic telegraph-typewriter circuit giving his name, license number of the plane, and point of departure and destination. This message is automatically reproduced on receiving machines at strategic points along the airway which note his progress. As he passes over these stations, messages to that effect are sent to stations backward and forward along the course, so that the approximate position of the plane may be known throughout the flight.

The standardization of communication facilities on the airways, however, is only one phase of these activities of the Aeronautics Branch. There are also the air-navigation maps; the efforts in behalf of uniform field rules, signal systems, the certification of aeronautical lights, and air marking.

The airway strip maps are prepared by the Aeronautics Branch in accordance with standards recommended by the Board of Surveys and Maps of the Federal Government. The strip maps deal with the airways and show communities, highways, airports, streams, railroads, high points, transmission lines, and other pertinent data to aid the airmen in following those specific routes. Another type of map, the sectional airway map, covers a much larger area, but it includes the established airways and the same general type of information as is presented on the strip map.

In an effort to bring about uniformity in airport field regulation throughout the United States, the Aeronautics Branch has prepared a set of suggested rules for adoption by airports and landing fields. These have been adopted by many airports.

Realizing that there exists an urgent need for the development of standard signal systems suitable for both day and night use, for controlling air traffic on and in the vicinity of airports, and for communicating special information to airmen, the Aeronautics Branch is conducting special research work on this subject in connection with its studies on airport traffic control.

The primary object of this research is to assist in developing safe and efficient methods of controlling air traffic at airports and to bring about uniformity in their application.

To further safety in air navigation, the department requires that all aeronautical lights, other than those established and maintained by the Federal Government, be certified by the Department of Commerce as true aids to air navigation. In order to serve as true aids,

such lights shall be long-range lights of suitable design, shall be distinctly aeronautical in character, and shall have color characteristics conforming to the uniform standard used on the Federal airways. They also are required to be in reliable operation from sunset to sunrise each night in the year, to mark an airport or landing field, a route leading to an airport or landing field, or a point from which bearings may be taken leading to an airport or landing field, an outstanding landmark serving as an aid to air navigation, or an area presenting a hazard to flying.

The Aeronautics Branch has also drawn up recommended standards to be followed in the marking of obstructions to air navigation. Provision also is made for marking hazardous flying areas and for the certification of high-explosive danger areas, the latter upon request by the owners of such areas.

The Aeronautics Branch has been active in an effort to stimulate the general use of a standard system of air marking by cities, towns, and villages that will convey the necessary information to airmen in the simplest and most effective manner. A recommended system for general use in this country has been worked out as a result of extensive studies and service tests made by a special committee to study the subject.

The branch recommends that such markings be placed on the most outstanding buildings or structures when suitable roof space is available, and should include the name of the city or locality, a meridian marker, and, if there is an airport in the vicinity, a combination of simple characters indicating the direction and distance to the airport, its rating and whether facilities are available for landplanes, seaplanes, or both. It also recommends a system for the marking of highways to aid the pilot in identifying them, as they stand out very clearly from the air and serve as one of his best landmarks.

Through the standardization of its communication facilities, the Aeronautics Branch has been of much assistance to the development of cross-country air travel. The system is being developed in accordance with well-defined plans and is being extended as rapidly as authorization and appropriations permit.

COMMUNICATIONS AND WEATHER SERVICE FOR AIRWAYS

By Charles F. Marvin, *Chief, Weather Bureau, United States Department of Agriculture*

Since the inauguration of an airways weather service in 1926, the necessity for rapid transmission of airways weather reports, forecasts, and warnings from center to center and from intermediate points on the airways to the centers has become increasingly apparent. Airplanes flying at speeds in excess of 100 miles an hour are subject to extreme variations in weather conditions within such a relatively short period that the weather reports received by the pilot must necessarily be the latest possible before entering a given area in order that these variations may be properly taken into account.

In the early days of the service, practically all communication was by telegraph and telephone, reports being made at such times as

to just anticipate the departure of a plane along the airway. This system is also used at present on a number of airways over which traffic is light, consisting possibly of not more than four plane movements a day. However, in practically all cases such as this these reports are now supplemented by radio broadcasts of terminal conditions, received by the pilot in the air so that in reality even that type of service is greatly improved under modern conditions.

Realizing that a more rapid means of communication and one which was constantly available for use was necessary, the Department of Commerce, which is charged under the air commerce act to provide facilities for air navigation, other than meteorological service, in 1928 installed a telephone-typewriter system between New York and San Francisco on the transcontinental airway. The telephone-typewriter, commonly known as "teletype," is essentially what its name implies; that is, it is a typewriting machine upon which, whenever a key is struck at one station, the impulse is electrically transmitted to every other machine on the circuit and actuates the same key on those machines, thus reproducing at all other points the identical message placed on the machine at the sending point. It will readily be seen that such a system provides for the instantaneous transmission of regular or special reports along an airway and permits the sending of any number necessary without additional cost, and thus peculiarly meets the needs of the airways service. The first year's test proved the efficiency of the teletype system as an aid to air navigation and it has now been extended to a large number of airways over which traffic is relatively heavy.

Hand in hand with the growth of the teletype system there has been established a large network of radio stations at principal terminals from which regular broadcasts of reports along designated airways are made. These stations are also equipped to handle radiotelegraph traffic. In addition to being located on airways equipped with teletype, they are also located at principal terminals along nonteletyped airways, and hourly reports exchanged and broadcast for these airways.

Now that we have a general picture of the equipment used, let us see exactly how it is used to provide needed weather information to the pilot of a transport plane operating, say, between New York and Chicago. We will say that the plane is scheduled to leave New York (Newark) at 9.30 a. m. About two hours before this time officials of the Weather Bureau at its various stations throughout the country, of which there are more than 200, have made observations of temperature, barometric pressure, cloudiness, precipitation, etc., and telegraphed the data to the forecast centers. Some of these reports are also received at the various stations themselves. At the forecast center at Washington, D. C., the signals are placed on the long-line teletype circuit between Boston and Washington, and, since there is a machine at Newark, they are, of course, received there. The Weather Bureau personnel stationed there then enter the data upon a base map, drawing in the proper lines for equal barometric pressure and temperature, and from this a general picture of the weather over the entire country is obtained. State forecasts extending over a period of 36 hours and a route forecast for the airway to be flown and extending over a period of 12 hours are made up at

Washington and transmitted by teletype to Newark. At about the same time that the regular reports to the forecast centers were telegraphed, certain selected stations from 100 to 200 miles on either side of the airway also transmitted to Cleveland by means of telegraph, teletype, or radio, airways weather reports giving general conditions, ceiling, visibility, wind, temperature, dew point, and barometric pressure. These were plotted on a special map at Cleveland and from this a special summary covering the area from New York to Chicago and a forecast of expected conditions in this area for the next four hours was prepared and transmitted by teletype to all necessary points, including Newark.

When the pilot arrives at the airport he finds that all this information is available for his benefit at the Weather Bureau office. If the weather appears at all unfavorable he may also discuss the general situation with the Weather Bureau official on duty.

In addition to the foregoing, the teletype has provided still further information, in that at a stated minute each hour all stations between Cleveland and New York (about 12) report the weather at that time in sequence; that is, one station immediately follows the one preceding in placing its report of weather conditions on the teletype, the sequence starting at one end of the circuit. These reports, when available in connection with the forecasts, map, and summary previously mentioned, complete the picture of the weather, as it is locally influenced by general conditions, and provides the pilot with an accurate outline of conditions to be expected.

However, the service to him does not end here, but extends to the flight itself, inasmuch as through his radio receiver he receives the broadcasts of later sequences, or in case of a decided change in conditions, special reports, made by the radio station. He is thus provided with a means of checking the progress of conditions as he has seen them shown on the maps and in the forecasts and has a definite knowledge of conditions both ahead and behind at all times.

It should be understood, of course, that the plan of service described extends, with slight variations due to topography, geographical location, etc., to practically all the heavily-traveled airways of the country and that all pilots flying the route may receive this service.

The importance of rapid communication to this system can not be overestimated. In fact, it can readily be realized that without it, no such service would be possible, and it is not too much to say that without this development the tremendous volume of air traffic now carried on would be very seriously hampered and very probably would not be practicable with any large degree of safety.

RESEARCH AS A BASIS FOR STANDARDIZATION IN THE ART OF COMMUNICATION

Dr. Frank B. Jewett, *President, Bell Telephone Laboratories (Inc.)*

While the above title covers communication broadly, the telephone industry may be chosen as one of the several arts of communication well representing the interdependence of research and standardization. The telephone itself, as has been stated many times, was born in a research laboratory, and a continuing program of research has

been the foundation built upon in the development of the telephone plant and in the expansion of the business. Following the invention of the telephone, those who undertook to develop the new industry were men of vision and imagination who saw clearly that the conditions to be met in such a broad use of the new facility as they foresaw were quite different from those underlying any previous art or industry. From its earliest days the telephone industry has shown on the one hand independence of precedent and on the other hand a keen appreciation of standardization intelligently applied. Care has been taken, therefore, in the telephone industry not to allow standardization to lead to stagnation, but rather to an orderly mode of progress. New standards for old things are being continually evolved, as a result of laboratory research, but these new standards are always tied in with the old.

Standardization has from the beginning of the industry been recognized as peculiarly a necessity in the telephone art. Telephone plant installed anywhere throughout the country must operate or perform efficiently in connection with apparatus installed in any other part of the country. The very intricacy of the switching operations for the rapid connection of any two telephones in the country and the complexity of the electrical transformation to transmit and reproduce speech clearly, resulting in a highly organized and inherently complex system, lead to an effort to avoid the still greater intricacy and complexity which would result if it were not for a high degree of standardization. It is no exaggeration to say that the telephone service of to-day could not be given without this standardization.

In addition to the fact that the inherent nature of the business makes standardization so essential, by this process the best is made available for all. This does not mean that in the telephone industry there may not be a number of standards so chosen as to meet varying conditions and at the same time to furnish best over-all results.

In addition to minimizing the complicated engineering and operating problems which would result from attempts to provide intercommunication between widely divergent systems and with widely divergent apparatus, there are the following rather obvious advantages from standardization. Material costs are reduced when under similar conditions in a large interconnected system all use identical items, permitting manufacture in large quantities. Standardization, likewise, reduces the cost of carrying stocks of material by reducing the number of types required; reduces the cost of instruction of new employees, because there are fewer things with which to get acquainted; simplifies plant accounting; and of particular advantage in a public service, such as the telephone business, it renders large supplies of material and labor more readily available in emergencies. Past standardization facilities the prompt and economical introduction of new standard types of apparatus and methods.

Standardization, without the knowledge accumulated from well-directed research, proceeds haltingly without any real assurance that in seeking to choose the best medium the whole field of choice has been considered and hidden pitfalls avoided. The telephone art involves the transmission of speech, hence the necessity of knowing

in definite terms the characteristics of speech sounds and corresponding speech currents. Having determined the characteristics of normal speech, it is equally important to determine how serious becomes any failure to transmit accurately those speech sounds from talker to listener. This determination also includes the effects of noise upon the circuit or in the room where the listener is located. This leads from a study of speech itself one step further back to a study of the mechanism of speech production and a study of the mechanism of hearing. Research has been actively directed to these subjects, particularly during the past 15 or so years, and the results obtained furnish a more definite knowledge of the basic material, namely, speech, with which the art deals.

Having defined, in so far as is possible, in definite physical terms the basic material with the transmission of which the art deals, namely speech, the next concern involves making available to any two persons who may wish to converse the most effective channel for the conveyance; that is, transmission of their speech. To do this requires the provision of an enormous quantity of physical apparatus, using the term "apparatus" broadly, and in the choice of this apparatus economic considerations become a recognized factor of great and in many cases controlling importance. Since, in general, considering portions of the problem there are several different methods of accomplishing a result, to choose the method which, weighing all the factors, is the best, presumes an accurate definition in quantitative terms of all those factors. While one of those factors is defined in economic terms, the other factors are largely defined in physical terms which in the last analysis rest upon the results of research.

As the primary concern in the telephone art is the conveying or transmitting of speech, for which the transmitting channel between the two terminal instruments is by means of either wire or radio or the two combined, it has seemed of prime importance that complete physical or technical data should be derived covering all possible methods of using such transmitting media. An enormous amount of such quantitative data has been secured from laboratory and field tests covering, for example, loaded and nonloaded open-wire lines, various types of cable construction loaded and nonloaded, and radio over a wide-frequency range. These investigations covered, in general, signaling frequencies, voice frequencies, and carrier frequencies. The availability of these quantitative physical data, together with economic data, has enabled the engineer to choose and standardize the transmitting channels best fitted to meet conditions involved.

Likewise, in that phase of the art of telephony involving switching or the process of providing a telephonic path from one person to another with whom he desires to converse, fundamental data, the results of technical research, together with economic considerations form the basis of the engineer's choice and standardization of the methods to be employed under varying but definitely definable field conditions.

Having spoken of the broader research activities underlying the telephone art, mention may be made of two more or less typical cases selected from many under way.

Magnetic materials, being of very great importance in the telephone art, have been for many years the subject of research. As one result of this work the Bell Telephone Laboratories developed permalloy, a nickel-iron alloy having as compared with the more familiar magnetic materials very extraordinary magnetic properties. Applications of this new material in the communication art seemed very possible, and further work has led to its use for the loading of submarine telegraph cables, its use in certain telephone apparatus, such as relays, and particularly to its use in compressed powder form in the cores of loading coils. The development and standardization of this type of loading coil has resulted in large savings.

The telephone companies have always been large users of timber for poles, cross arms, conduits, pins, and other items used in the construction of the outside plant. At an early date experience showed that poles, even when selected from species most resistant to fungus attack, such as cedar and chestnut, were, nevertheless, quite vulnerable to decay at the ground line. Other species were available, such as southern yellow pine, which would make desirable poles, except for their tendency to decay rapidly, even in the section above ground, unless some form of preservative was applied. Over 30 years ago investigations were begun by the Bell system covering the technical and economic aspects involved in the use of poles treated with preservatives to protect them against decay and insect attack. At that period of abundant timber supply small economies, if any, could be expected from the use of pole preservatives, but, as time went on, with the depletion of timber supply and the increase in its usage, there was foreseen, as has actually developed, an economic demand for pole preservation which has fully justified the constantly increasing program of investigation. An early step undertaken was the collection of data as to the performance of southern yellow-pine poles, full length pressure treated with creosote by processes then commercially available. Also, as the cedar and chestnut supply began to show restrictions, further experiments, both in field and laboratory, were conducted in the treatments of the butts of these species with creosote by brush or open-tank methods, and still later by the spray method.

It is obvious that there are many variations possible in the methods which may be employed in treating pole timbers and in the preservatives used. It therefore became necessary to study the effect of these variations and to try to determine those qualities in the finished product that it would be most desirable to obtain. By applying laboratory methods, it has been sometimes possible to accelerate the tests so as to reach a decision on the value of a treatment long before it could be determined in the operating plant. As might be expected, many of the apparently promising treatments investigated have proved worthless or unreliable. With research going hand in hand with standardization, it is possible to avoid heavy losses that would result from the wholesale use of untried materials in the plant. Standardization, while gradually changing with our increasing knowledge, has been so employed as to confine operating practice to the use of that which is currently known to be the best and more accurately to define that best. By our present standardized treatment, cedar and chestnut poles have had from 15 to 20 years added to

their average physical life, and the southern yellow-pine pole, which normally could not be expected to give more than a few years' service, can now be employed with assurance of an average physical life well over 30 years.

STANDARDIZATION IN A NATIONAL SYSTEM OF TELEPHONY

By H. S. Osborne, *Transmission Engineer, American Telephone & Telegraph Co.*

Possibly the most useful analysis of the standardization activities of the Bell system is to consider them as related to the principal impelling motives which lead to standardization.

The first of these motives arises from the necessity of properly coordinating the operation of a far-flung and intricate telephone plant to facilitate the rendition of satisfactory service. An example is given in the electrical requirements applied to circuits which are designed to form parts of long connections. Without standardization it would be entirely possible that, while each element of the circuit was satisfactory from the standpoint of its own localized service requirements, service over a combination of circuits would be unsatisfactory or impossible. Another illustration is given by the traffic operating practices; convenience to the customers and to the operators both require that the methods employed in different parts of the country be closely alike to avoid difficulties in handling calls.

Coordination of service over a widely distributed plant as a motive to standardization may vary in importance with the type of industry. The second impelling motive, however, is common to every rapidly changing industry. This is simplification of practice to obtain increased flexibility.

Numerous instances might be cited of standardization which is principally for this purpose. The telephone plant must be capable of adjustment to meet growth and other changes in conditions. In meeting this requirement it is found economical to limit plant additions to a few standardized types of apparatus. For example, toll cable conductors are made up practically entirely of two gages, and 95 per cent of the conductors for local distribution circuits are of three sizes. Not only is the range of conductor sizes limited, but, furthermore, the electrical transmission systems formed by associating these conductors with loading, repeaters, carrier current systems, and other apparatus are very limited in number. The same process has been applied to the telephone-switching systems. There are but five standard types of manual switchboard filling the needs of both common battery and magneto service and two general types of dial equipment. While the amounts of different items of switching equipment naturally vary between offices, a specific installation can be made up by an assembly of standard units of one of these standard types.

Closely allied to the advantage arising from the flexibility which results from simplified practice is the economy of mass production. In so far as it is practicable to manufacture a smaller number of different articles, the number of each article is increased with resulting economies. In the case of relays, for example, it has been possible by careful design of parts to build up relay types capable of a

wide number of uses and which differ chiefly in the detail assembly of standard piece parts. The large-scale production of identical units has been one of the important factors which has made possible large economies in the production of telephone equipment during the past few years.

A part of the standardizing work is directed toward satisfying the severe technical requirements placed upon telephone apparatus. An example of this is found in the standardization of raw materials. Much of this work is carried out in cooperation with the American Society for Testing Materials. Important recent standards include the establishment of requirements for sheet brass, nickel silvers, and bronze. Impact tests suitable for molded and sheet insulating materials have also been developed, and suitable tests for die castings, including tensile strength, elongation, hardness, and impact strength, have been worked out.

Another motive for standardization that has been prominent in the programs of many standardizing bodies, as well as in the work of the Bell system, is that of safety. A great deal of attention has been given to developing standard safety provisions for the outside construction forces. In this work a very active part has been taken by representatives of the employees themselves, who are in the last analysis directly responsible for the effective application of the safety standards adopted. This work has resulted in standard safety codes adopted by each of the operating companies.

A type of situation in which questions of safety are very important has to do with cases of proximity between wire lines of telephone companies and those of other wire-using utilities. Standards regarding type and strength of construction have been established for such cases in cooperation with other utilities involved, and many of these standards are included in Part II of the National Electric Safety Code.

Finally, an important motive in Bell system standardizing work is to make the best immediately available to all. The recommended types of apparatus, operating methods, and practices are the result of the accumulated experience of the manufacturing and operating departments and of the work of a large number of highly trained people in the headquarters departments whose time is devoted principally to devising improvements. These recommended standards are adopted not because they are labeled "standard," but by virtue of the fact that they represent the results of adequate studies of the best way to meet a type of situation. On the promulgation of a new apparatus standard the manufacturing branch of the system can, therefore, proceed at once with the preparations for manufacture and even, in many cases, to start manufacture of the new product in advance of the receipt of orders. This can be done with full assurance that the standardized product will be used and that it will not be necessary to manufacture a large number of slight variations of the same thing to meet the slightly varying operating requirements or the whims of different purchasers. The process leads to the immediate information of all concerned regarding the new standard and to shortening the time required to make it generally available.

Another way in which standardization tends to make improvements quickly available to all is that it simplifies the process of

development itself. New apparatus or telephone systems must be coordinated with existing plant. Standardization reduces the number of things with which this coordination is necessary and therefore facilitates the development work.

There are, of course, other motives for the standardization work, but it is believed that what has been said is enough to point out the fundamental rôle which standardization plays in the operations of the Bell system. A standard in the Bell system is a means to an end rather than an end in itself. The purpose of standards is to facilitate progress and in so far as they do this, that progress may soon result in a new standard to replace the old. A standard is a stepping-stone, a stable basis on which to operate while preparations are made to advance to the next step up the hill of progress.

STANDARDS IN TELEGRAPHIC COMMUNICATION

By C. E. Davies, *General Commercial Engineer, Western Union Telegraph Co.*

In telegraph communication service, standardization of equipment and operating practices has come, because of constant effort, to improve accuracy and increase speed. Reduction of expense has, of course, followed as a natural consequence.

Within the past few years the average time required to handle telegrams has been greatly reduced. This has been accomplished by decreasing the standard time limits established for each operation and by intense supervision of thoroughly trained employees, who work with greatly improved apparatus. Improved standard forms of transmission and routines for handling corrections have also been responsible for faster speed of service.

Inspection of several modern telegraph offices would impress an observer with the fact that the apparatus and general arrangement in all offices is essentially uniform, and that the employees all follow the same general procedure in the performance of their respective tasks. This is the result of painstaking research to discover and apply the simplest, most efficient methods of handling telegrams and to provide equipment and office layouts that eliminate as many unnecessary operations as possible.

One of the major factors in improving the speed of service has been the rapid development and standardization of the printing telegraph. Replacing the Morse method of telegraphy, it has not only increased transmission speeds, but has considerably reduced the uncertain human factor that is inherent in Morse operation. This change has, moreover done much to place the business on a basis where speed is subject to engineering development and has made it possible to look with confidence to still further improvements, which will permit the maximum speed attainable by the highest type of operators to be utilized.

It is possible to determine the maximum speed attainable by operators at any given time, and while the standard thus set will undoubtedly improve as time goes on, the rate of increase will be slower and slower as perfection is approached. However, standards of equipment and operating practices which now exist or will be de-

veloped in the near future will take care of the probable increase in operating efficiency for years to come. This state of affairs, which has only existed in recent years, has resulted from engineering research, which has met the economic need for apparatus and circuits that work at higher speeds than were even dreamed of a few years ago. Standards that were entirely satisfactory then are no longer sufficient to meet to-day's requirements, and they have passed into disuse as new standards are developed. The present goal in apparatus and line speeds is the removal of all mechanical and electrical limitations to operators' productivity. Development of the ultimate in operating personnel is now going forward under increased effort as it becomes apparent that the maximum of efficiency is a definitely measureable quantity.

Another major factor in the advance of telegraphic communication has been the standardization of the printing telegraph as a means of speeding up the pick-up and delivery of messages to large users at terminal cities. Supplementing messenger handling, it has, in many cases, provided a means of exchanging messages between customer and telegraph company much more quickly than would be possible in any other way. This development necessitated standardization of equipment, both in customers' offices and in the telegraph company's operating rooms. In the latter, concentration units specially designed for the work have, by means of signal lights that flash the instant a call is received, facilitated the prompt answering of patrons who wish to send telegrams. Operators are able to connect their machines to any of a large number of circuits without moving from their positions. The number of idle operators is indicated by lights, thus permitting better assignment of forces and lowering costs.

Intraoffice belt conveyors and pneumatic-tube carrier systems, operating at almost double their former speeds, have been adopted as the standard methods of moving messages from circuits on which they are received to those on which they are sent. High-speed tubes are also standard for use to near-by branch telegraph offices where conditions are such as to permit their installation.

Dissemination of market quotations over ticker circuits has been speeded up by the development and standardization of high-speed tickers that operate at 500 letters a minute, as compared to a maximum of 300 letters a minute on older types of equipment. The new speed greatly reduces delays to market quotations during periods of intense trading activity at the New York Stock Exchange.

There are, of course, hundreds of minor ways in which standardization has served the telegraph business with excellent results. Standards of illumination that increase efficiency, standard-unit switchboards, universal repeaters, tables, signs, blanks, etc., are a few of the many examples that might be mentioned. Naturally, rapid advances in the telegraph business have, up to now, caused many standards to assume a status of semi-permanence. They have, however, served their purpose, and as long as they continue to be replaced by higher ones the country is assured of having the best possible telegraphic service.

COMMUNICATION WITH QUASI OPTICAL WAVES

By Eduard Karplus, *Engineer, General Radio Co.*

In recent years a new branch of radio communication has been developed that has been spoken about rather frequently in public but that has not been applied very much. It is communication with waves below 10 m, with quasi optical waves, or ultrashort waves as they are generally known.

The following paragraphs deal with characteristics of these waves and show how they can be produced and applied. It is pointed out also how important standardization would be and how standardization only would prepare the field for their general use.

The length of waves applied in radio communication up to now varies between some several 10,000 and 10 m. It has been agreed on to measure these waves not in wave lengths but in frequencies. Radio communication, therefore, uses the band between 10^4 and 3×10^7 cycles per second. Lower frequencies comprise the range of audio frequencies and of the commercial alternating currents with 60 or 25 cycles per second. Higher frequencies include at first the range about which we are going to speak in this article, then the range of visible light and of ultra-violet and Röntgen radiation. In this range of high frequencies again it is advantageous and in common use to speak of wave lengths. The wave lengths of the visible light, for instance, are between 0.4 and 0.8 μ (1 μ=1 micron=0.001 millimeter), and the quasi optical range extends between 0.8 μ to 10 m.

That vast range of more than 23 octaves, of course, is not subject to uniform laws, but still there is something common to these waves that justifies bringing them into one range. It is the fact that all these waves are radiated only in straight lines. The curvature of the earth and mountain ranges are insurmountable obstacles to them, and when the wave length is decreased even smaller objects in the path of radiation can shut off communication. Below 1 m, for instance, it is not possible to communicate between different buildings in a city, and in the range of heat and infra-red, radiation can be interrupted by tiny screens of sheet metal or even cardboard.

Due to the straight-line radiation, fading never is observed in the quasi optical range. Another important fact is the possibility to concentrate radiation with rather simple apparatus in one direction and to eliminate radiation in every other one. It is remarkable, too, that the noise level of these waves is very much less as compared with other waves used in radio communication. Almost every speed of modulation is possible, as the carrier frequency at all these waves is extremely high. Very important, too, is the performance under various atmospheric conditions, especially in fog.

To produce waves from 1 m up, regular vacuum tubes can be used. Below 1 m, however, regular circuits can not be used; but with an electron oscillator, consisting mainly of a vacuum tube, continuous waves down to a few centimeters can be produced. Professor Barkhausen, in Germany, was the first to show that possibility. Below a few centimeters there seems to be no way to produce

continuous waves. From 1 mm up, spark, oscillators can be used, and harmonics of these have been ascertained up to the limit of the heat waves, let us say, 0.1 mm. The next following range of heat and infra-red radiation down to the limit of visible light is best produced in temperature radiators and in electrically excited gases.

It is quite interesting to note that most of the light sources that we are using produce much more infra-red and heat radiation than visible light.

However, practical communication is possible with only a small part of the quasi optical range because of atmospheric conditions. Theory and practice show that waves between a few microns and a few centimeters are scattered and absorbed in the immediate vicinity of the transmitter. For applications, therefore, two distinct ranges are available, the range between 0.8 and 2 μ and the range between 5 cm and 10 m. The group of longer waves is practically independent of humidity of air, fog, and rain, as is true for all the other waves used in radio communication. The waves of the lower range, however, are affected to some extent by humidity of air and fog, but still they are much more capable of penetrating the atmosphere than waves in the range of visible light.

In both groups application is limited to communication between near-by points, as radiation is limited by the more or less necessary "optical path."

Of the commercial applications, the following should be mentioned: Communication between scattered points between which, for one reason or another, a cable can not be established, as happens sometimes at sea or in the mountains and where other frequencies are not available for radio communication. Another application is broadcasting in large cities where again the regular broadcasting transmitter can not be used due to the limited number of available frequencies, and where all the difficulties arising in common wave broadcasting should be avoided.

The most important application, however, is the problem of navigation in fog, both at sea and in the air. A very interesting solution for fog landing of airplanes has been shown by the Bureau of Standards. Before that system or another similar one could be applied on a large scale, however, it will be necessary to create a very extended organization. Other applications of quasi optical waves include signaling communication for military and police purposes. For increased concealment and better penetration in fog, waves between 0.8 and 2 μ have quite a few advantages as compared with visible light.

In the range of broadcast and commercial radiocommunication, maintenance of frequency is most important as far as the organization is concerned. Conditions are somewhat different in the quasi optical range. The technique is not capable to-day of maintaining waves below 1 m with such a high degree of accuracy as is required in commercial radiocommunication; but that is not necessary as interference with other lines of communication is not likely to occur, due to the limitation of distance and the effects of concentration that are possible at quasi optical waves. Signals in the quasi optical range can be sent in the same way as light signals in different directions from one point without regard to the frequency. It is characteristic

of the whole situation that, in general, no one would mention the wave length or the color of light used for communication.

Quasi optical waves, therefore, are a very good means of communication whenever a large number of transmitters have to operate at the same time in a limited space. That is the case, for instance, in a port in fog or on a landing field for airplanes. Experiments have shown that reliable transmitters and receivers can be built, and many laboratories are actively developing them.

But still the necessary organization is missing. There is no use, of course, in equipping a few boats with communication systems that would penetrate fog. These boats could pick out each other, but they could not detect a boat or a rock that has not been included in the system. Likewise, there is no use in furnishing an airplane with fog-landing apparatus when the pilot could only use it in his home port, as it seems still more important for safety that he should be able to use any other flying field or even emergency landing places.

Before introduction of fog-landing equipment can be thought of, a certain method and a certain apparatus should be standardized and a law required that would enforce the use of this equipment on all boats and all airplanes and landing fields.

AMATEUR RADIO COMMUNICATION

By C. A. Briggs, *American Radio Relay League*

The amateur radio operators are primarily interested in communication and in this connection they are concerned with a number of standards of international application, some of which relate to measurable quantities and some of which relate to practices. The success and leadership of the American amateur has made him dominant in the field, and the subject must be considered largely from his activity in international amateur radio communication.

First, the amateur has been defined by the Federal Radio Commission as a person interested in radio technique solely with a personal aim and without pecuniary interest. In this class are included a large number of individuals ranging from persons of outstanding achievement or skill to persons just beginning to gain a knowledge of the subject.

In general, the ideas held in foreign countries respecting individual liberty of action has caused the position of the amateur radio operator to be less favorable than it is in the United States. Many European governments have only lately become reconciled to the idea of licensing amateurs at all. Great Britain has licensed amateurs, but is pretty strict with them, and the present United States amateur progress would not have been possible under the English regulation. Canadian amateurs, however, are not so restricted. France is quite liberal with its amateurs judging from the number of French stations transmitting. The Belgian authorities have just recently revised their entire radio law, and in doing so have provided for their amateurs. However, they do not license their amateurs in all the bands provided for amateur use by the 1927 International Radio Convention. Spain has extended to its amateurs full privileges under the Washington treaty according to the best recent information. Portugal licenses its amateurs with

fairly liberal privileges. Italy prohibits amateurs. The Russian authorities are very liberal with their amateurs, encouraging them and there are many very fine Russian amateur stations. Most of the Scandinavian countries are very fine in their attitude toward amateur radio, and there are strong national societies with good membership in Norway, Sweden, Denmark, and Finland. There is quite a bit of amateur interest in Poland. In Czechoslovakia amateur progress is being held up pretty badly due to what has now become a stalemate between two "national societies," each claiming to represent Czechoslovakian radio. Probably the strongest European amateur society representing the largest and most enthusiastic group of European amateurs is the German society, the Deutscher Amateur Sende- und Empfangsdienst. German amateurs are remarkably like our American amateurs in their age, general attitude toward the game, enthusiasm, etc. Switzerland has now begun to license amateurs to communicate with other European nations.

In general, European nations are disinclined to favor general licensing in the 1,715 or 3,500 kilocycle bands; they prefer to keep these frequencies for police, aircraft, etc.

Outside of Europe, there is a tendency to be more liberal. South Africa has an active group of amateurs with a strong national society. The authorities are sympathetic and give the amateurs full support. New Zealand and Australia are both active and come much closer to our American ideas of amateurs than do any European group, with the possible exception of Germany, as already noted. There is quite a bit of amateur interest in some countries in South America, but this often means phone rather than code.

The standards of first interest to the amateur are standards of frequency. Frequency has replaced wave length as a means of designating just where in the radio spectrum a radio transmission is located; that is, for instance, just where it will be found in tuning a receiver. The frequency of a signal corresponds to the number of complete electrical oscillations per second which characterize it. The number per second is very large. For instance, a frequency of 1,000,000 complete cycles per second is one of those used for broadcasting and corresponds in ordinary conditions to a wave length of 300 meters in air.

In order to reduce the number of figures required to express them, radio-frequencies are generally given in kilocycles; that is, in terms of thousands of cycles per second. Thus, the frequency of 1,000,000 cycles per second is expressed as 1,000 kilocycles.

The bands of frequencies assigned to amateur stations in the United States, and the approximate values of the wave lengths in air, are:

Kilocycles	Meters
1,715– 2,000	175 –150
3,500– 4,000	87.5 – 75
7,000– 7,300	42.8 – 41.1
14,000– 14,400	21.4 – 20.8
28,000– 30,000	10.71 – 9.67
56,000– 60,000	5.35 – 5.00
400,000–401,000	.749– .748

Of these, the following bands may be used for amateur radio telephony, under suitable conditions:

Kilocycles	Meters
1,715– 2,000	175 –150
3,500– 3,550	87.5 – 84.46
56,000–60,000	5.35– 5.00

Amateurs use various means for spreading their relatively narrow band to occupy increased angles on the dials, and employ signals of known frequencies in and out of their bands for standardizing their equipment. Many amateurs maintain their transmitters on definite frequencies so they may be used by others for calibrating purposes.

In general, the amateurs construct battery-operated weak tube oscillators mounted in copper or aluminum boxes which serve as hetrodyne-frequency meters (wave meters) which are calibrated and constitute a repository for standard frequencies. A phone connection in the plate supply enables such frequency meters to be used for adjusting transmitters. The frequency-meter dial is set for the frequency designated and the transmitter is adjusted to give a zero beat note as heard in the phones, the detecting action of the oscillator being sufficient to produce the required effects in the headset.

For standardizing the frequency meter or for measuring incoming signals, the weak signal from the oscillating frequency meter is picked up in the amateur's receiving set and the dial of the frequency meter is varied until it makes a zero beat note with the incoming signal. The result is used for calibrating the frequency meter or for measuring the incoming signal, according to the purpose of the observation.

The most recent type of frequency meter consists of a special form of oscillating-frequency meter known as a dynatron oscillator. This employs a screen-grid tube in a special circuit in which a high degree of constancy and reliability may be obtained.

By the exercise of ingenuity and the use of harmonics many amateurs succeed in obtaining many calibrating points from a small number of signals heard.

Of peculiar interest is the fact that a new and standardized form of language has been evolved by the radio amateurs which permit them to get communications through and completed which would otherwise be impossible under the circumstances. It is based on abbreviations which are very practical and present an interesting example of a logical and well-founded practice arising out of experience. It is world-wide, and, on account of the energy of the American youth in developing radio, it is based on English. This language is sufficiently comprehensive that young amateurs have sometimes talked to each other without realizing that neither could speak the other's language.

This air language is characterized by an abbreviated and apparently phonetic spelling of most of the words. However, the phonetic aspect is produced by another guiding principle, unconsciously ap-

plied, which is to make everything as brief as possible. For instance, "my" becomes "mi." This is because "mi" (— — · ·) can be made in a shorter time than "my" (— — — · — —) as the "i" is shorter to make than the "y."

Time is very important. The amateur works with varying and uncertain conditions, with transmitters of low power, and with interference of all sorts often amounting to a bedlam. Frequently contact is made and communication established only with great difficulty. The curious brief air language has a tremendous effect in permitting intelligent contact to be made and messages to be exchanged.

To illustrate the compact nature of this special language: One amateur, W3NY, after being answered by a second station, W3CAB, proceeds as follows:

"W3CAB de W3NY R ge om tnx fr call ur fb dc sigs qsa 4 R 5 in Balto hr 2 msg fr Wash qsh? qrk? qri? qsb? ar."

In ordinary language this means:

"W3CAB being called by W3NY. I hear you, good evening, old man. Thank you for calling me. Your fine business direct current signals are of good readability and quite strong here in Baltimore. I have two messages for delivery in Washington (D. C.). Will you take them? What is my signal strength? What is the character of my signal and what is my frequency? Go ahead."

Here, 78 characters conveyed information which required about 284 characters to explain in simple plain English. Notice the polite forms of "good evening" and "thank you." The only place where amateurs sacrifice brevity is in politeness in opening or closing a transmission, and curiously enough this is sometimes elaborated to the point where one amateur substantially thanks another amateur for thanking him.

The international Q signals consisting of 3-letter groups beginning with Q, having a special meaning and used in radio as a result of international agreement, form a part of the amateur's vocabulary. However, the amateur sometimes extends them to 4-letter groups to cover some special need.

The vocabulary for this air language used by the amateurs can be found in its authentic compilation in the "Radio Amateur's Handbook" issued by the American Radio Relay League, with headquarters at Hartford, Conn. The majority of radio amateurs are members of this organization.

The amateurs also make use of other quantities which are not reduced to precise measurement and standardization, but are determined by judgment. These include readability and strength of signals and signal character. The readability or audibility is expressed in a scale of from 1 to 5, established by agreement. These are: (1) Hardly perceptible; (2) weak, readable now and then; (3) fairly good, readable, but with difficulty; (4) good, readable; and (5) very good, perfectly readable.

The strength of signals are expressed on a scale of from 1 to 9, in which 1 represents a signal which can just be heard, and 9 one of the loudest signals possible. A signal may be loud, but conditions may make its readability poor.

The quality of signals are generally given according to their sounds, as determined by the plate supply and type of oscillator used in the transmitter and are expressed:

RAC, rectified alternating-current signals.
DC, direct-current signals.
PDC, pure D. C. signals, specially good.
XRAC, crystal-control rectified alternating-current signal.
XDC, crystal-control direct-current signals.

Regular prearranged calling and listening times between definite stations, called schedules, are established by amateurs and where the respective Governments permit, messages are handled. In America, particularly in the United States, the number of schedules established and messages handled are large. Generally, these schedules are established by radio contact and often form parts of communication nets which may cross the continent.

The amateurs of the various countries are generally members of organizations which reflect their interest. The largest amateur organization is The American Radio Relay League with headquarters at West Hartford, Conn. This cooperates closely with the International Radio Relay League, which also has headquarters at West Hartford, Conn., and grew out of the first-mentioned organization. It is largely through these organizations that the amateurs must defend themselves from adverse interests.

The international character of amateur radio and its world-wide uniformity has frequently enabled amateurs to pick up signals reporting disasters in remote places and make contact with the operators, thereby expediting the sending of assistance. For instance, one case was reported where weak emergency signals sent from an Asiatic island were received in the United States and caused immediate action to aid the expedition.

PERFORMANCE STANDARDS TO AID IN BUYING RADIO SETS

By Orestes H. Caldwell, *editor of Electronics and Radio Retailing*

For the past year the radio business has been in utter confusion and the public has been mystified when it came to buy a radio set.

Confronted with all kinds of conflicting claims and prices set up by manufacturers and dealers, the general public has pretty nearly lost all sense of the values involved in radiobroadcasting receivers, with the result that "now no one knows what to pay for a good radio set."

Externally sets look much alike, and, without standards or ratings of performance by which to be guided, the layman is likely to buy a set far below the level of tone quality and sensitivity which he would have otherwise demanded had he known how important these two factors would be to his future enjoyment of his purchase. As a result, homes throughout the land are full of poor, tinny-sounding sets, the public's musical ear is being injured, and the radio industry can not understand why the level of price demand keeps continually lowering.

The above conditions exist in spite of the fact that the standards of broadcasting have been continually rising and the service of the great stations has been steadily improving in point of tone value,

power, and field strength to override static and interference, both man made and natural.

During the past few years the leading broadcasters have spent millions to improve the quality of their transmitters; to enable the sounds delivered to the microphone to go out on the air with the full range of frequencies, high and low, which insure naturalness and reality. Only high-quality receivers will respond to this full range of tones, shown in the accompanying diagram. The inadequate and obsolete receivers can reproduce only a few octaves out of all the musical riches which are in the night air, free to everyone for the mere picking up.

Until recently the radio industry did, to some degree, meet the situation created by falling prices and wavering specifications by "selling up." The time has now arrived, however, when the industry needs help from other directions if it would keep its business on a sound and profitable basis. The dealer particularly needs this outside help because he is all but conquered by the following factors: (1) The public's "low price" complex, (2) its lack of confidence, (3) its inability to judge true tonal and other quality values, (4) the dealer's own inability to demonstrate convincingly the relationship of price to quality.

The time has arrived, therefore, for the industry to set up some standards for the determination and presentation of comparative values. It should not be hard to fix scales of tone fidelity, sensitivity, and selectivity on which each radio set could be rated with some rough attempt at comparative valuation.

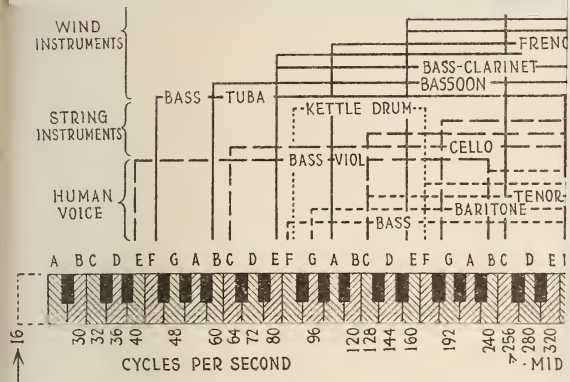
We must, in other words, set up a yardstick or set of standards by which radio sets can be simply and clearly rated in terms of performance and tone quality. This would be analogous to the ways of rating automobiles in performance or horsepower. In the early days of the automobile industry, nothing of this kind was available, and the public was not able to judge the real character or merit of a car. Nowadays all this is standardized, to the benefit of the public, the automobile manufacturer, and the automobile trade.

Such a plan of rating radios in terms of standards would stabilize this overwrought business of radio by revealing clearly to each buyer just what he is getting for the price he pays.

PROGRESS AND NEED OF STANDARDIZATION IN THE RADIO FIELD

By J. W. Horton, *Chairman, Standardization Committee, Institute of Radio Engineers*

Standardization, in the field of radio engineering, is as old as the Institute of Radio Engineers, for the first committee on standardization was appointed in 1912 "for the express purpose of studying the terms and symbols used in the art, selecting and defining suitable terms, and eliminating the remainder." The committeee on standardization for 1912–13 had only six members, but as a result of a number of meetings and informal discussions, presented the "Preliminary Report of the Committee on Standardization" as a supplement to volume 1 of the Proceedings of the Institute of Radio Engineers.



Point at which sense of feeling begins, before sense of hearing

WIRE TRANS

Television wire circuit

Highest-class wire line

Ordinary wire circu

Ordi

T

S

RADIO BROADC

Modern broadcasting transr

Broadcasting stati

High-quality radio s

Obs

SOUND

Public-addres

Dynamic loud-speake

Exponer

Electro

SOUND RECORDINGS

Highest type electrical trancription

Sound-picture film sound track

Sound-picture disc rec

HOME

Modern electric re

Recent

MISC

Niagara Falls 40 to 50

Thunder 20 to 40

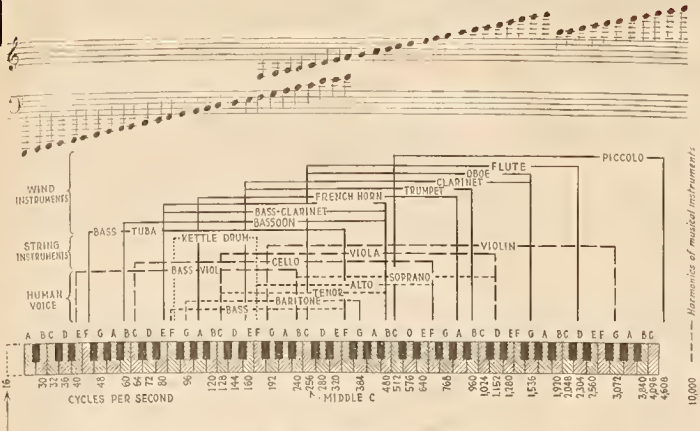
Distant gunfire

60-cycle A.C.

Average man's speaking voice Av 128

Average woman's speaking voice Av 256

Electronics' Chart of
Sound Frequency Characteristics



Point at which sense of feeling begins before sense of hearing

WIRE TRANSMISSION CIRCUITS

- Television wire circuit (20 to 18,000 cycles per second)
- Highest-class wire line for broadcasting (50 to 8,000)
- Ordinary wire circuit for broadcasting (50 to 5,000)
- Ordinary telephone talking circuit (150 to 2,150)
- Trans-oceanic telephonic cable (300 to 2,500)
- Standard telephone instrument (300 to 1,800)
- Early telephone lines (500 to 1,600)

Door squeak

RADIO BROADCASTING AND RECEPTION

- Modern broadcasting transmitter (30 to 7,500)
- Broadcasting station transmitting chain program (90 to 5,000)
- High-quality radio set (50 to 5,500)
- Obsolete or poor radio set (256 to 2,200)

Chirp of insects

SOUND REPRODUCERS

- Public-address system (60 to 5,500)
- Dynamic loud-speaker (40 to 5,500)
- Exponential loud-speaker (70 to 5,500)
- Electro-magnetic pickup (60 to 5,500)

SOUND RECORDINGS FOR RADIO AND FILMS

- Highest type electrical transcriptions for radio (Nilt & dale cut) 30 to 10,000
- Sound-picture film sound track recording (0 to 8,500)
- Sound-picture disc record 33⅓ r.p.m. lateral cut (60 to 6,000)

HOME PHONOGRAPHS

- Modern electric recorded home phonograph (60 to 5,000)
- Recent acoustic phonograph (90 to 4,500)
- Old fashioned phonograph (256 to 3,000)
- Office dictating machines (350 to 2,000)

MISCELLANEOUS

Niagara Falls 40 to 50

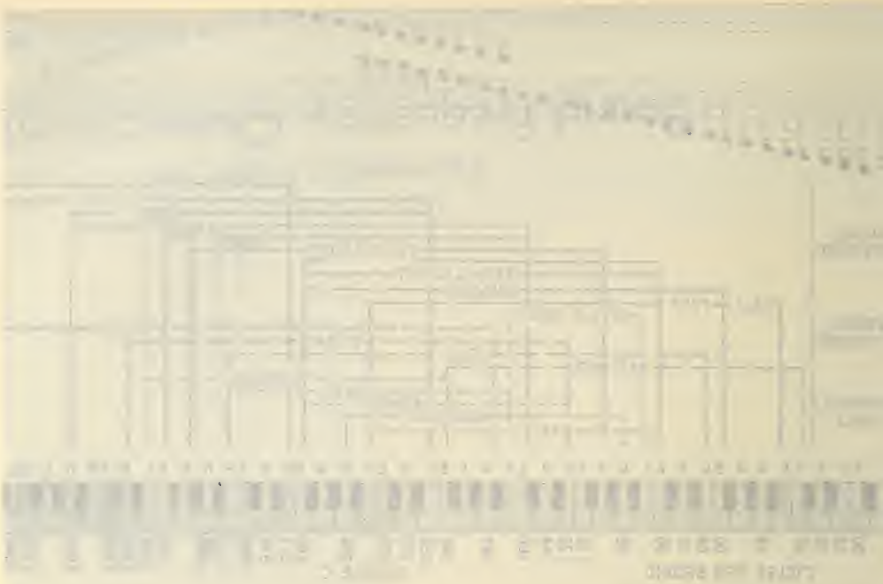
Thunder 20 to 40

Distant gunfire

60-cycle A.C.

Average man's speaking voice Av 128

Average woman's speaking voice Av 256



This "Preliminary Report of the Committee on Standardization" contained 13 pages of definitions of terms in which 136 terms were defined, 4 pages of literal symbols in which 109 mathematical symbols were given together with their recognized meaning, 2 pages of graphical symbols containing the drawings of 32 symbols for use on schematic wiring diagrams, and 1½ pages of tests and ratings of transmitting equipment. The entire preliminary report, therefore, consisted of 23 pages of radio standards intended primarily for the engineer.

The work started by the six members of the committee on standardization in 1912 has been continued from year to year. The I. R. E. has always maintained a committee on standardization and has issued succeeding standards reports in 1915, 1922, 1926, 1928, and 1931.

By 1930 the institute's committee on standardization had increased from 6 to 46 members, and its work had become so involved and specialized that it was found impracticable for one committee to assume the responsibility for the institute's standards reports. Accordingly, four technical committees were organized, each headed by a specialist in his particular field, to prepare the detailed definitions and individual reports. Under the chairmanship of Dr. J. H. Dellinger, the committee on standardization left to the technical committees the work of organizing new material, and acted primarily in the capacity of supervising the activities of the technical committees, establishing policies, and coordinating and approving the definitions, symbols, abbreviations, and other reports originated by the technical committees.

As a result of 31 meetings of the committee on standardization and its four technical committees, the institute published its "1931 Report of the Committee on Standardization" in March, 1931. In contrast with the original preliminary report, this report contained 334 definitions of radio terms under 9 principal headings, 13 pages of mathematical and graphical symbols, a 22-page report on "Tentative Suggested Methods of Testing and Rating Radio Transmitters and Antennas," a 23-page report on "Standard Methods of Testing Broadcast Radio Receivers," a 33-page report on "Standard Methods of Testing Vacuum Tubes," a 15-page report on "Performance Indexes and Tests of Electro-Acoustic Devices," and 2 pages of safety standards regarding the "Provisions for Safety of Operating Personnel in Relation to Radio Transmitting Equipment."

During the early part of 1931 the committee on standardization was reorganized and an additional technical committee was appointed. At the present time these five technical committees are engaged in a revision of the 1931 report and are adding a considerable amount of new material. It is anticipated that the next report of the committee on standardization can be made available during the early part of 1933.

The National Electrical Manufacturers Association has also been actively interested in standardization in the radio field and has published a reference work of practical information concerning the manufacture, test, and performance of radio products. Whereas the I. R. E. standardization reports are of interest primarily to

engineers, the N. E. M. A. report is very largely concerned with standards and specifications which are of primary interest to the manufacturer of radio equipment.

Realizing that standardization by manufacturing groups has greatly benefited industry, the Radio Manufacturers Association has been active in standardization matters since its inception. In setting up its own standards, the Radio Manufacturers Association recognized the work done by the N. E. M. A. and has adopted a number of N. E. M. A. standards as its own. The R. M. A. standards cover such items as markings, ratings, limits, and tolerances of radio products, testing methods, and instructions, and certain definitions applying to radio receivers.

There are now two organizations actively engaged in radio standardization work. The standardization activities of both the Institute of Radio Engineers and the Radio Manufacturers Association naturally overlap somewhat, although in general the I. R. E. is concerned with engineering standards, whereas the R. M. A. deals with manufacturing problems. Duplication of effort in radio standardization matters is avoided by complete cooperation between the standardizing committees of the Institute of Radio Engineers and the Radio Manufacturers Association.

Together with the American Institute of Electrical Engineers, the institute has been joint sponsor of the sectional committee on radio of the American Standards Association, and became a member body of the American Standards Association in October, 1930. At the present time the sectional committee on radio has prepared a 44-page report, covering definitions, dimensions of vacuum-tube bases and sockets, test methods, and manufacturing standards, most of which have been taken from the I. R. E. and R. M. A. standards reports. It is anticipated that this report may be presented to the American Standards Association for adoption as American Standards before the end of the year (1931).

Although considerable progress has already been made in setting up standards not only for the engineer, but for the manufacturer as well, the need for standardization in the radio industry is one of increasing importance. Electrical interference, both natural and man-made, is still a source of considerable annoyance and expense. Fortunately, it is possible to reduce greatly the amount of man-made interference by the proper design, not only of the broadcast receiver, but of such pieces of electrical equipment as motors, violet-ray equipment, vacuum cleaners, heating pads, elevators, and the like which are the cause of most "manufactured" electrical interference.

Television, which we have been told for so long is "just around the corner" will present standardization problems of its own when this method of communication finally emerges from the laboratory, but it is not too soon to give serious thought to the problems which television will occasion. The television receiver will be a much more complicated piece of equipment than the ordinary broadcast receiver, and unless efforts are made through standardization to provide for some unified system of scanning, it is not only possible, but highly probable, that a receiver designed to pick up a picture made up of, let us say, 3,600 elements per frame with 20 frames per second, will

not be able to reproduce pictures of 4,000 elements per frame with 24 frames per second. Standardization is thus essential to insure that a single television receiver will be designed to receive all pictures broadcast just as the modern broadcast receiver can pick up any broadcast program by merely turning the tuning control knob.

In the field of comparatively new developments, the phototube is one of the objects requiring standardization in the near future if maximum benefit is to be derived from this important electrical tool. At the present time phototubes are being manufactured in all sizes, shapes, and characteristics. The result of this lack of standardization is that commercial applications are difficult to make and one can not be sure that a tube purchased for replacement purposes will operate in the same manner as the unit it replaces. Standard methods of measuring and rating phototubes, as well as setting up specifications and characteristics which are recognized as standard will assist in making the most out of commercial applications, will increase the number of commercial applications, and will reduce to a minimum the number of types of tubes which will be necessary.

Standard tests have already been originated by the Institute of Radio Engineers for the measurement of characteristics of broadcast receivers, but the importance of the frequencies above the broadcast band makes the adoption of test methods of high-frequency receivers a necessity. Related to this problem is one dealing with the proper design of high-frequency signal generators.

Standard methods for measuring frequency, for making accurate and rapid surveys of field intensity, and for mounting and operating quartz crystal resonators are other problems which require standardization in the near future. The Institute of Radio Engineers realizes that the need for standardization in the radio field is more acute than it has ever been before, and is already attacking some of the problems mentioned above.

STANDARDIZATION OF NAVAL RADIO MATÉRIEL

By Rear Admiral Samuel M. Robinson, *Chief, Bureau of Engineering, United States Navy*

Standardization is the lifeblood of the material end of the naval radio communication system. In fact, it is considered of such importance as, in general, to be secondary only to the item of operating efficiency and reliability of equipment and is often given precedence over these factors. This arises from the fact that the naval communication system must function reliably 24 hours a day under conditions of long periods of absence and great distances from a source of supply and subjected to rigors far greater than any met with in normal commercial practice.

Because of the conditions under which naval radio equipment must function and to which it is subjected, among them the extreme temperatures, excessive humidity, and extreme vibration and shock, the percentage of failures of many component parts is inherently rather high. This occurs in spite of every effort to incorporate in all component units of naval radio apparatus as high factors of safety as are compatible with the space and weight limitations im-

posed, and the most rigorous requirements in all specifications under which radio apparatus and its component parts are purchased.

In order that the very minimum number of replacement parts need be carried in stock, the Bureau of Engineering of the Navy Department has been most insistent that, in so far as the progress of the art permits, only component parts previously standardized by the Navy be employed in its equipment.

The policy of standardization is also necessary from a naval point of view for two important reasons—one military and the other commercial. From a military point of view, the best interests of national defense demand that, wherever practicable, all consumable items should be obtainable from as many sources of supply as possible. This obviously predicates the necessity that the outputs of such sources of supply shall be standardized to a point of electrical and mechanical interchangeability. From a commercial point of view, it is desirable and, in a sense, necessary that as many manufacturers as possible be encouraged to bid on proposals for such consumable supplies. This is not only a legal requirement, but tends toward the encouragement of commercial enterprise which, in turn, builds up additional sources of supply, thus aiding in the military effectiveness stated above.

Concrete evidence of what has been accomplished in the interests of standardization by the radio division of the Bureau of Engineering, will be found in consideration of some of the smaller but very important items connected with the manufacture and maintenance of radio equipment. As an example, a few years ago, the products of different manufacturers of vitreous enameled resistors differed in mechanical dimensions, electrical ratings, ferrule sizes, etc. At the present time, it is possible to obtain from not less than six manufacturers of vitreous enameled resistors, units entirely similar electrically and mechanically, and hence entirely interchangeable in the apparatus in which they are used. Vacuum tubes have similarly become standardized, due in a great part to the Navy's insistence that all tubes of similar types obtained on its specifications be entirely interchangeable and function with equal efficiency in any of its equipments. Radio insulators have likewise been standardized to the point where a high percentage of the Navy standard insulators may be obtained from many manufacturers working in three or more different materials, but all meeting the requirements and specifications of the Navy.

The list of the Navy's achievements in the field of radio standardization is so formidable that the above examples represent but a small part of it. As the art develops, so do the possibilities of standardization, and it is evident, from the necessity for such action as just outlined, that no effort should be spared in arriving as near the goal as possible.

STANDARD RADIO-FREQUENCIES AND THEIR DISSEMINATION

By J. H. Dellinger, *Chief, Radio Section, Bureau of Standards*

The fundamental standard in radio communication is that of frequency. In order that the maximum number of radio messages or programs may be transmitted simultaneously, it is necessary that

the frequencies of the radio waves which carry them be maintained very accurately. If the frequency varies, the message or program will interfere with others carried on adjacent frequencies. Therefore, the maintaining of frequency accurately is a basic requirement of all radio operation.

This requirement makes it necessary that means be provided to insure that all stations operate accurately on the same frequency. Fortunately the standard of frequency has the unique property that it can be made widely available by means of radio transmission. Radio waves, of which the frequency is carefully controlled and accurately known, furnish a standard of frequency which is simultaneously available everywhere that the waves can be received.

To meet this need, the Bureau of Standards has provided a standard frequency service regularly since 1923. It has transmitted special waves from its own station, on announced frequencies which have been carefully measured in terms of the national primary standard of frequency maintained by the bureau. The transmissions are at scheduled times announced and published in advance. Their accuracy has at all times been more than adequate for the needs of radio service. These needs have become more and more rigorous, and the accuracy of the bureau's standards and of the transmissions has progressively increased. The accuracy has now become so good that the standard frequency transmissions serve adequately every purpose of time-rate standards as well as frequency standards. The technique of the transmissions has also improved; the waves actually transmitted are held constant to the same accuracy as that of the primary standard itself, upon which the transmissions are based. The accuracy is better than 1 part in 5,000,000.

It is the aim of the bureau to make these transmissions with adequate power and on suitable frequencies to provide reliable frequency standards and time-rate standards everywhere in the United States. The nature of radio-wave transmission is such that when this is achieved, a fair service of the same kind will be rendered throughout a large part of the world; and it may be possible eventually to make the service actually reliable and available throughout the whole world. During the present year the transmissions are made every Tuesday for two hours in the afternoon and two hours in the evening. Arrangements have been made to extend this so as to provide the same service every day instead of only one day a week. It is expected that this extended service will be on the air within the next year. The program contemplates eventually making the service continuous all day every day. If this goal is achieved a frequency and time-rate service will then be available at all times and places.

A few details of the transmissions may be of interest. At the present time they are carried on with a transmitter of 1-kilowatt power. In the new transmitter, about to be installed, this will be increased to 20 kilowatts, which should be adequate. The principal transmissions are on a frequency of 5,000 kilocycles per second. They have been received and utilized satisfactorily practically everywhere in the United States, including the west coast and Alaska. The frequency mentioned is a satisfactory one for night use. It is expected to use 15,000 as well as 5,000 kilocycles for the daytime

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transmissions. Some transmissions are also made on a variety of other frequencies, but the 5,000 and 15,000 kilocycle transmissions are expected to furnish the principal service. Other frequencies, such as 10,000 and 20,000, may be used if found necessary to cover greater distances reliably. Besides the carrier frequencies mentioned, it is expected to have the transmitted waves carry one or more modulation frequencies. The frequencies tentatively in view are 5,000 cycles per second and 60 cycles per second. The former will have a variety of uses for radio and physical purposes. The use of a 60-cycle modulation is discussed further below.

The applications of this service are many. It has been used in the past principally for the calibration of standards of radiofrequency used by radio laboratories, manufacturers, and transmitting stations. This serves a most useful purpose in putting the radio stations of the country more and more on a single frequency basis, and thus contributing to the minimization of radio-station interference. It is expected that the service will be used more and more for direct control of the frequency of radio transmitting stations. Stations can receive the waves and operate amplifying and frequency-changing apparatus so as to directly control the frequencies of the waves which they in turn emit. As this application develops, one of the most fruitful results is expected to be the synchronization of broadcasting stations. When two or more broadcasting stations operate on a frequency which is accurately the same instead of only approximately so, heterodyne interference is eliminated and the service area of such stations is greatly increased. Such synchronizing is carried on to a very limited extent at the present time by means of a synchronizing frequency carried by wire line, which is a very expensive process.

Another purpose served by the transmissions is the furnishing of a convenient means of intercomparison of the principal frequency standards and clocks of the world. The fact that these transmissions give a standard which is available from instant to instant instead of available only by integrating processes over long intervals (as in the case of time signals) makes them advantageous for this purpose. If it is found useful, a special signal can be put on the standard frequency transmission at prearranged times to indicate a specific summation of a number of cycles, thus facilitating the use of the transmissions as time-duration signals. Persons engaged in physical measurements, geodetic, seismological, and similar work can, by the use of simple receiving equipment, receive the signals and utilize them by means of chronographs, etc., for whatever time-rate or time-duration purposes they desire.

Mention has been made of the plan to have the transmitted waves carry certain modulation frequencies. One of the possible applications is the synchronization of television apparatus. An audio-frequency of a suitable value for this purpose could be included as a modulation frequency. The operators of television systems could receive the waves and utilize this modulation frequency for the synchronization of rotating apparatus both at the transmitter and the receivers for visual broadcasting. No definite plan has been worked out on this, and it remains to be seen whether this would be a useful field of application. Another field of synchronization which can be

served by these transmissions is that of the electric-power stations. The interconnection of 60-cycle power plants throughout the country would be facilitated by a universally available 60-cycle frequency which would give a means of control whereby different generating plants could be kept accurately in phase. The same service would insure that electric clocks operated by the power systems would keep accurate time.

The transmission of standard frequencies has been developed to some extent in Europe. Such transmissions are made once a month from the Eiffel Tower station in France, and from the National Physical Laboratory in England.

RADIO AIDS TO NAVIGATION

By J. H. Dellinger, *Chief, Radio Section, Bureau of Standards*

Radio is responsible for great advances in the safety and accuracy of navigation. The navigational uses of radio have a history of about 20 years on the sea, and about 10 years in the air, and are of rapidly spreading importance at the present time.

Radio aids navigation in two principal ways, as a means of communication and as an instrumentality of navigation on course finding. Radio provides the only means of communication to ships or aircraft at a distance, and has destroyed the isolation of ocean voyages. As an instrumentality of navigation, radio serves to provide either (*a*) a homing means; that is, means to reach a desired point; (*b*) a means of navigating a desired course; or (*c*) a means of determining position. Radio functions regardless of fog, tempest, or distance, and thus provides unique services which are bound to be of increasing value to navigation. It supplements rather than displaces other navigational aids, such as the compass, sextant, and sonic depth finder.

The differing requirements of marine and aerial transportation have led to different kinds of uses of radio. In the marine service, radio communication is mainly telegraphic, although telephony has been added recently on the larger vessels. In aviation, radio communication is mainly telephonic. In the uses of radio as a navigational instrumentality, the principal marine system utilizes radio direction finders aboard the vessels to determine the line of direction of radio signals from a known source, while the system used in aviation in the United States employs directive radiobeacons which mark out the directions of the airways and are received with nondirectional receiving apparatus on the aircraft. Another navigational system employing direction finders on land to determine the line of direction of radio signals from the moving vessel has been used in marine navigation and is the method used in aerial navigation in Europe.

The Bureau of Standards has been active in the development of the various radio aids to navigation. The system of aids to marine navigation is now standardized throughout the world. There is a great deal of activity at the present time in developing and extending the use of radio in connection with air navigation. In the United States the research phases of this work are carried on by

the Bureau of Standards for the Aeronautics Branch, Department of Commerce.

The system of radio aids to navigation on the airways of the United States has the advantage that it imposes the minimum requirements on the airplane operator. There are many other possible systems, but they require more specialized equipment aboard the airplane or require more attention or some manipulation in use. The directive radiobeacon system enables a pilot to continue along the regularly traveled airway when no landmarks, sky or lights are visible. It largely removes the chief limitation on reliability of scheduled flights, viz, delays due to fog. This system tells the pilot as soon as he veers from his course, indicates on which side he is off, shows him the way back, and informs him when he arrives at his destination.

To use the radio aids provided by the Government, an airplane need be equipped only with simple radio receiving apparatus. Transmitting stations for radiotelephony are located on the ground, usually at airports about 200 miles apart. At these airports are located also the directive radiobeacon transmitting stations. The radiotelephone stations send out messages regarding weather, landing conditions, etc., while the beacon stations send out directed signals of a special type for the sole purpose of making out the line of the airway. A single receiving set aboard any airplanes receives both classes of service. Thus, any number of airplanes may be served simultaneously. This is one advantage of the system over the European system which can serve only one airplane at a time. Another advantage is that the airplane is required to carry only a receiving set, whereas in the European system the airplanes must be equipped for transmission as well as reception.

A number of air transport lines in the United States do provide transmitting apparatus aboard their airplanes, and carry on 2-way communication with ground stations owned and operated by them. This system supplements the Government system which gives service to all airplanes whether or not they carry transmitting apparatus.

There are now on the airways of the United States 88 directive radiobeacon stations, and 62 radiotelephone stations broadcasting weather and other information to airplanes in flight, all maintained by the Government, and operating on low frequencies. There are, in addition, 107 radiotelephone stations operating on high frequencies, maintained by the air transport companies for 2-way communication with airplanes in flight.

The use of radio as a navigational means has still further possibilities. Collisions between airplanes in fog are a real hazard; experiments on a radio warning system to obviate this danger are in progress. Another use of radio in navigation, which is advancing even more rapidly to the stage of practical use, is the aiding of airplanes to land under conditions of low or zero visibility. The radiobeacon system is adequate to guide airplanes along the airways, but no means have hitherto been provided to insure a safe landing in heavy fog. Radio has been applied to this problem with marked success, giving the pilot full information, during the movements of landing, of his position laterally, longitudinally, and vertically. When this method for blind landing is in operation on a

routine basis, the aviator will be indebted to a radio for a comprehensive system of navigational aids.

THE VELOCITY OF RADIO WAVES

By N. Ernest Dorsey (*Principal Scientist, Bureau of Standards*)

That the velocity of radio waves is believed to be the same as that of light is well known, but the basis on which this belief rests is not so generally known. Few realize that, as yet, it is impossible for us to measure directly the velocity of radio waves with anything like the precision with which we can measure the velocity of light. How, then, is the equality established?

Before that question can be satisfactorily answered, it is necessary to recall certain, apparently irrelevant, facts pertaining to the subject of units, those basic amounts in terms of which others are measured. If the distance between two points is 1 yard, it is also 36 inches. The same distance is here expressed by either of two different numbers (1 and 36), the difference arising from the fact that they refer to different units of length (the yard and the inch), one unit being 36 times as long as the other.

As the yard and the inch are both used for measuring lengths, so, in association with each system of mechanical units, two different units are used in measuring the size of an electric charge. One, called the electrostatic unit, is based upon the force of repulsion between two equal charges when placed in a vacuum and at a certain distance apart. The other, called the electromagnetic unit, is based upon the amount of charge that must be transported per second by an electric current in order that the current shall produce a certain magnetic field. In the system of units that is based upon the centimeter, the gram, and the second, these two units differ greatly in size, one electromagnetic unit being nearly 30,000,000,000 times as great as one electrostatic unit.

Now, in 1864, before radio waves had ever been observed, J. Clerk Maxwell, the great British physicist, demonstrated that the existence of certain well-established phenomena of other kinds required the existence of such waves, and that, in a region of zero electrical conductivity in which certain electromagnetic properties (dielectric constant and magnetic permeability) are independent of the frequency [1] of the waves, such waves must travel with a velocity that is numerically equal to the ratio of the electromagnetic unit of charge to the electrostatic unit, which ratio we may, for brevity, designate as the ratio of the units. That ratio can be measured in the laboratory, and even to-day such measurements afford the only precise basis for an estimation of the velocity of radio waves.

In 1864, the sole available determination of the ratio of the units gave the value 3.11 10^{10} cm [2] per second, while the measurements of the velocity of light ranged from 2.98 to 3.15 10^{10} cm per second, the lowest being considered the best. The value for the ratio refers to frequencies far below those of radio waves, which, in turn, are

[1] The number of wave crests per second that pass a given point.

[2] 10^{10} cm = 10,000,000,000 cm, 10^{8} cm = 1,000,000 cm. Hence, 3.11 10^{10} cm per second = 31,100,000,000 cm per second.

far below those of light. On the basis of the similarity of these values, Maxwell announced his famous electromagnetic theory of light, which states that light is an electromagnetic phenomenon, that the only essential difference between light, radio waves, and other electromagnetic waves is one of frequency. In doing this, he inferred that throughout the enormous gamut of frequencies extending from the frequency corresponding to the determination of the ratio of the units (less than one wave per second) to the highest frequency of visible light (750 millions of millions of waves per second) the velocity in a vacuum remains unchanged. If this inference is correct, the ratio of the units should be exactly equal, numerically, to the velocity of light. Whence arises the great importance that has been attached to the determination of these two quantities. Every increase in precision has brought them nearer together; and every pertinent discovery since Maxwell's day has strengthened our belief that light is an electromagnetic phenomenon.

The most accurate existing determination of the ratio of the units was made at this bureau 25 years ago, at a frequency of about 500 waves per second. It involved the value of a certain resistance, which was afterwards determined at the National Physical Laboratory, London, in terms of a velocity. A combination of these determinations gives for the ratio of the units the value $2.9979\ 10^{10}$ cm per second, which is believed to be correct within about a unit in the last place, although in the original paper the uncertainty was said to be "not more than 1 in 10,000"; that is, not more than 3 units in the last place.

The most accurate determinations of the velocity of light are those of the late Prof. A. A. Michelson. Those made in 1926 give the value $2.99796\ 10^{10}$ per second, with a probable error of 4 in the last place. Preliminary notices indicate that more recent, and as yet unpublished, observations will yield essentially the same result.

These two values, both referring to vacuum, differ by less than the uncertainty in the less accurate, which is itself 1,000 times as accurate as the values available to Maxwell. This essential agreement of the values found at the two ends of this enormous gamut of frequencies makes it highly probable, though not absolutely certain, that the same velocity applies throughout that gamut, and probably well beyond it.

Our belief that radio waves in a vacuum travel with the speed of light rests on this probability, which conflicts with nothing that we know, and which is strengthened by the fact that such other information as we have bearing upon the subject uniformly indicates that the actual velocity of radio waves must lie close to that value.

This velocity, $2.99796\ 10^{10}$ cm per second, is equal to 186,285 miles per second, surpassing every other known velocity. If the waves could be confined to a circular path, they would circle the earth 7.5 times in a second; they can travel from the earth to the moon and back again in a little over 2.5 seconds, and to the sun in 500 seconds (about 8.3 minutes). That the direct measurement of such an exceedingly high velocity involves many difficulties is obvious, and that in the case of radio waves we are still unable to make it with precision is not surprising. Some day, it will be done.

RELATION OF STANDARD TIME TO INTERNATIONAL COMMUNICATION

By R. E. Gould, *Chief, Time Section, Bureau of Standards*

Since the earth makes a complete rotation of 360° in a day of 24 hours, each interval of 15° longitude on the earth's surface corresponds to a time difference of 1 hour. For example, when it is 12 o'clock noon at any given point on the earth's surface it is 12 o'clock at all points on the meridian passing through that point, 11 o'clock a. m. at all points on the meridian 15° west of that point, and 1 o'clock p. m. at all points on the meridian 15° east of that point.

While theoretically each 15° interval represents a time difference of 1 hour, in actual practice the time-zone boundary lines are somewhat irregular, and their actual location is seldom in exact agreement with their theoretical position. In the United States the location of time-zone boundaries is under the jurisdiction of the Interstate Commerce Commission, and in fixing these boundaries consideration is given to such factors as topography, local desires, and location of railroad terminals.

Before the days of railroad trains, automobiles, airplanes, telegraph, telephone, and radio, when people either stayed at home or moved from place to place at relatively slow speeds and there were no means of quick communication, it was customary for each community to use local mean time. There was little occasion for concern as to the exact time in other distant localities.

The development of world commerce and means of quick communication and transportation brought about a need for a world standard of time, and in 1884 a convention was called in Washington to consider the subject. As a result of this meeting, the meridian passing through the Observatory at Greenwich, England, was chosen as the prime meridian from which world standard time should be reckoned. With this meridian as a starting point the world was divided into 24 zones of approximately 15° in width, the time in each differing from the next zone by one hour. In the United States proper there are four of these time zones, based on the seventy-fifth, ninetieth, one hundred and fifth, and one hundred and twentieth meridians, the time in the various zones being slower than Greenwich time by 5, 6, 7, and 8 hours, respectively.

The adoption of standard time zones, each having definite boundaries within which all points are abritrarily given the same time, makes it possible to follow a definite rule for changing time when passing from one time zone into an adjacent zone. In traveling from east to west the traveler sets his watch back one hour on passing a time-zone boundary line, since the time in the zone he has just entered is an hour earlier than in the zone he has left. Similarly, in traveling from west to east the traveler sets his watch ahead an hour on passing from one time zone into the adjacent zone, the time being one hour later in the zone he enters than in the one he leaves.

From the foregoing it is apparent that if the traveler should continue entirely around the earth, changing his watch hour by hour as his journey progressed, he would have gained or lost a full 24 hours by the time he returned to his starting point, and his time reckoning would be a full day in error.

In order to avoid all uncertainty as to the date at any point on the earth's surface and to establish the position at which the traveler should make his correction of a day, it was agreed internationally and has become universal practice to make the change at the one hundred and eightieth meridian. This is known as the international date line. On passing this line from east to west the traveler repeats one day, and on passing it from west to east he omits a day; that is, he sets his calendar back a day, or ahead a day, in the same way that he has set his watch on crossing a time-zone boundary line.

Navigators, to a very large extent, travel on Greenwich time and so overcome the necessity of changing their timepieces every time they pass from one time zone to the next.

To assist in maintaining correct time, several of the principal nations transmit daily time signals checked by comparison with the motion of the heavenly bodies. The type of signals varies somewhat, but the purpose is the same in all cases, to furnish a standard for world communication and commerce.

With this system of international time in operation, communication between nations and the correlation of dates has been greatly improved from that of a few generations ago.

Let us consider some examples of the use of international standard time. An aviator leaves England, 0°, at 5 a. m. and arrives in New York, 75° W., at 11 a. m. the next day. What was his actual time of flight? Apparently it was 1 day and 6 hours; but, since New York is 5 hours slower than the time in England, we add 5 hours to the apparent time and find that he actually took 1 day 11 hours to make the trip.

A ship leaves New York, 75° W., on Monday at 7 p. m. and arrives in Liverpool, 0°, on Saturday at 6 p. m. Apparently the time for the trip was just 1 hour short of 5 days, but when we consider the difference in time we find that the trip was made in 4 days 18 hours, actual time.

Some of the practical advantages of our international time system are readily appreciated, and these advantages will almost certainly be greatly increased as means of international travel and communication are still further developed.

COMMUNICATION BY RACING PIGEONS

By W. F. Dismer, *Washington, D. C.*

Perhaps the first mention made of any means of communication is that recorded in Genesis 8:8, which cites that Noah successfully used the dove as the subject of his errand. It was, therefore, no surprise that we were asked to contribute something on the subject of communications as rendered by the racing pigeon—worthy successor to the bird before mentioned.

We frequently meet people who consider it marvelous that all that is necessary is to tie a message around a pigeon's neck (the worst possible part of its anatomy for the purpose), whisper into its ear, and forthwith it will deliver the message intrusted to its care, permitting itself to be caught and petted.

But while the racing pigeon can not do miraculous things, it still remains in a class absolutely by itself in one respect—a message intrusted to its care remains a secret between sender and receiver when delivered on the day of release. No other means of communication can make a similar claim. Whatever its method of delivery, there is some way of intercepting it.

The pigeon hobby is perhaps as old as any pastime. The use of pigeons as messengers is first recorded 6,000 years ago, when, as history tells us, they were used by the Chinese. In the twelfth century, Caliphate, the Sultan, kept in touch with every city in his empire by the use of pigeons, and it is history that had his successor taken even a casual interest in the winged messengers the empire would not have fallen. Rumors have it that the Rothschild fortune was built up by the news which racing pigeons brought the house of the arrival of rich caravans, days in advance of their competitors.

During the siege of Paris in 1870 the only communication the Parisians had with the outside world was by employing racing pigeons. Communications were established by taking pigeons out of Paris at night by balloon and then dispatching them with messages. Fifty balloons, taking 350 pigeons, of which 60 made good their returns between September 30 and January 27, in spite of a vigorous winter and the watchful eyes of the Germans, is recorded. Comparing this record with those made by the American pigeon during the World War indicates the wonderful development and improvement in less than half a century. In the latter conflict we must bear in mind that special attention was directed to the pigeons to prevent their functioning, yet the records prove that 97 per cent of the messages intrusted to their care were safely delivered in wonderful time.

What relief the pigeons brought to Ladysmith and Mafeking is history; in Morocco, telegraph and telephone were found untrustworthy and impossible for the moving columns of the army.

Many years ago pigeons were extensively used in Alpine climbing. Three stations at varied altitudes, each with a complement of pigeons, received reports of accidents, avalanches, fogs, and other troubles incident to Alpine climbing.

During the Balkan War we read: "Airplanes have been used by the belligerents to facilitate rapid movements and secure information of the whereabouts, disposition, and strength of the enemy with only varying degrees of success." But suppose their success had been unqualified and complete. It seems as though the aviator, in order to carry out his work effectively and expediently, should keep in continuous connection with headquarters. By the use of racing pigeons this could have been greatly facilitated and simplified.

It was, however, in the World War that the pigeon won for itself a lasting and undying fame. With the telegraph and telephone cut and wireless rendered unserviceable in the presence of enemy counterwaves, news of the invasion was sent from village to village in Belgium by racing pigeons, and if owners were shot dead it was not because they kept pigeons but because they sent and could continue to send out information in a way that could not be stopped. How much of the heroic defense of Belgium was made possible by the prompt and efficient transmission of information borne by pigeons probably will never be known with exactness.

Wires may be cut, wireless destroyed, but nothing yet made can recall a pigeon once flown with news of his country's invasion and peril.

Every schoolboy nowadays knows the story of "Cher Ami." The achievement of that wonderful pigeon is kept ever alive as she stands in the war collection at the National Museum with a brass plaque telling of her wonderful deed. When all other means of communication had failed, when the enemy were so close to the Lost Battalion that their voices were audible, a message was intrusted as a last resort to the care of "Cher Ami." Through hell-fire she sped with the speed of a bullet; and although she lost a leg and an eye and was otherwise torn by shot, she safely delivered the message which notified headquarters of the peril of General Whittlesey, for the globule containing the message was intact. At a base hospital General Pershing came to see the bird, and he ordered that the highest medical skill be provided to save her life. She came back to this country after the war but died less than three months later.

In peace time there are fields where the use of pigeons for communication purposes is indispensable. Perhaps none is more apparent than during the season when forest fires are prevalent. Many of these are discovered miles away from telegraph or wireless stations, and valuable time is lost in communicating the discovery. Were pigeons available news of the fire could be sent speedily.

During the winter at Yellowstone Park the monotony of many a lonesome hour, day, and week could be broken by the use of pigeons. When the guards are shut in, so to speak, for the winter and have no outside communication excepting, perhaps, what might be received by radio, but not delivered, these men could nevertheless get some pleasure in hearing from one another once in a while by pigeons.

Or, let us take the case of the diphtheria epidemic up in the far north some years ago, when a real man with his faithful dog team just was able to bring the antitoxin in the nick of time. Certainly an isolated case and perhaps never to be repeated, but there is no denying the fact that a few trained pigeons would have performed within a few hours what it took many days to accomplish.

So we may go on reciting cases where pigeons could be used for communications in a manner not possible by any other means. No wonder, then, that Uncle Sam retains a few, if only a skeleton crew at that, for use in emergency and is keeping a few well-trained men who could be called upon at any time.

Like a good race horse, a good racing pigeon may be of any color. The foundation of the American racing pigeon came from Belgium about 60 years ago, but England has been the largest contributor to the importation during the present century. The only strains we care to mention are from a few of those who have gone to their reward. Hansene and Gits and Barker, of Belgium, the latter an Englishman who emigrated to Belgium; Logan, Wones, and Osman are outstanding strains of England.

However, the American racing pigeon, the result of the "boiling pot" proved in the World War that he has no equal. It has been pointed out that the American pigeons are not compelled to face a body of water like the English Channel or the mountains which some of the Belgian pigeons encounter. Nevertheless, when put to the test in the great conflict, none surpassed the American pigeon in either speed or reliability.

Every record is held by the American pigeon, be it for speed or distance. Our returns on the day of liberation from the 500 and 600 mile races surpass those of other countries. We will cite only one record—that of long distance. The longest distance ever flown was that by a bird of our friend, Lieut. E. S. Peterson, of San Antonio, the gentleman who was in charge of the Navy pigeons "over there." A pigeon released in competitive flight up in Maine was timed home by Lieutenant Peterson in San Antonio, Tex.—a distance well over 2,000 miles.

After six months' separation the veteran pigeon fanciers pair their birds in the early spring, and, having in mind that "like is likely to beget like," they usually mate their best birds together. About 20 days after the first of the two eggs is laid the youngster is hatched and in another week or 10 days receives its identification mark in the form of an aluminum ring, bearing initial, year of hatch, and numbers. As the young bird's leg becomes larger this ring can not be removed or another put on. During the incubation one finds, as a general rule, that the male bird will be covering the eggs between 10 a. m. and 4 p. m., the female performing her duties during the other hours of the day. However, after the youngsters become 10 or 12 days old the male bird does most of the feeding to make up, as it were, for his seeming laziness during the incubation.

At the age of 4 or 5 weeks the young follow their parents out of the loft and soon are on the wing. Many a youngster has been given his first lesson in homing before he is 6 weeks old; but as the clubs usually provide a schedule in the spring for the older birds and one in the fall for those hatched that year, we find most of the pigeons to be 3 or 4 months old before being placed in training. Perhaps its first lesson is always to return immediately to the loft after exercising, it being tempted to do so by the meal which awaits it. The cardinal difference, it might be said, between a racing pigeon and all other kinds of pigeons is that the racing pigeon will never alight on any home excepting that of its owner or in its own loft. Moreover, even when given the run of the loft, it will usually be found inside of the loft.

The actual training consists of liberations away from the home of first 1, then 3, 5, 10, 20, 35, and 50 miles before being ready for the first race. Brought to headquarters, each pigeon is marked with a secret rubber ring, which is recorded opposite the pigeon's aluminum ring number, whereupon each member receives his sealed clock. Each loft is measured from liberating points by a surveyor, the distance being figured to the thousandth of a mile, or approximately 50 feet.

On the morning of liberation the members are acquainted with the time of the start and the weather conditions; and the veteran flyer, taking into consideration these conditions, is usually able to judge the probable time of first arrival within 15 or 30 minutes. When he sees his bird in the air, he uses every enticement to get the bird into the loft to enable him to get the racing ring to place in the clock. While some birds "trap" very quickly, others do not do so well; and any noise is likely to frighten them, with the result that valuable time is lost.

The same evening, the clocks are brought to headquarters, where first the times are noted from the clocks' printed slips, then the racing ring checked, the times adjusted (for some clocks will run fast while others will run slow), and finally the average speed in yards per minute figured, as this is the best unit in determining winners.

Any and all birds are eligible for the old bird races—color, age, weight, or previous experience proving no bar, but only birds bearing rings with the year of hatch are eligible for the young bird races. Diplomas are presented the winning birds; diplomas are also awarded the best combined average for each season.

Two national organizations regulate the welfare of the sport in America: The American Racing Pigeon Union and the International Federation of Homing Pigeon Fanciers. At their annual conventions there is, perhaps, a larger attendance in proportion to the membership than any convention of whatever nature.

These annual gatherings are not for legislative purposes but, rather, for a rekindling of old friendships and the creating of new ones. Of course, business meetings are held and various phases of the sport discussed, but all voting is done by referendum. Twenty years ago one of these organizations inaugurated the attendance of ladies at their banquets, perhaps one of the first conventions to do so, and at present we find that at least 25 per cent present are of the fair sex.

At least a thousand members and their friends attended the twenty-first anniversary of the American Racing Pigeon Union at its reunion at the Commodore Perry Hotel at Toledo, Ohio, in October, and a like number celebrated the fiftieth annual meeting of the International Federation, which was held at Brooklyn, N. Y., in November.

Pigeon racing is an ideal all-the-year sport. It is found as interesting to the boy as to his grandfather. No sport can compare with it, democratically speaking. And, as for fraternalism, nothing makes brothers of one another so quickly as this wonderful hobby.

Communications will continue to be carried on on a larger scale by every agency other than the racing pigeon, but always bear in mind that if you want a secret communication—that sent and delivered by racing pigeon is the only absolutely secret one.

SOME STANDARD MEANS OF TRIBAL COMMUNICATIONS

By Dr. Walter Hough, *Head Curator of Anthropology, Smithsonian Institution*

Standardization in primitive arts shows only rudimentary beginnings with the inception of material culture. The expressions are mostly in terms of the nearest standards found in parts of the human body, as the arms and digits, which developed extensively before the scientific advance.

Means of communication depending on the eye and ear are referable to another field not connected with metrics. Language and gesture, growing up together as we believe, represent an early agreement or standardization of meaning. These would be used for communication over not very great distance; thus, language, near by; gesture, medium distance; and signals, for distance.

Sign language, which was a familiar feature of Indian communication, had developed at the coming of the white man into a general system intelligible over a large part of the United States west of the Mississippi. The signs represented form and motion, conveying to the mind a picture; that is, signs were ideographs, an extension of picture writing. Necessarily, the speakers must have light in order to communicate, so that aside from artificial light sign language was a day language.

Much more effective was signaling which could be carried on at any time. The familiar visual signals with fire and smoke form a picturesque phase of primitive life. The night fire and day smoke served to convey simple messages to a far distance. By puffs of smoke separated by manipulation of fuel and a blanket or by number of fires the Indians signaled. At night by moving a blanket before a fire some information was conveyed. The code was simple and previously agreed upon among friends. Sometimes fire arrows were shot up at night and by their direction or curves to right or left conveyed a message. There are many references in ancient writings to these methods of signaling.

Wigwagging a blanket was a customary method of signaling by the Indians. Riding a pony in a circle or other figure was also a common device.

Even whistling signals were sent by some Indian tribes. Travelers record that they could be heard over incredible distances.

Sound signals were of proved usefulness among primitive peoples. The agents employed were drums and wooden gongs, the latter sometimes huge excavated logs of hardwood producing a massive sound penetrating to a long distance.

In the Congo, Herbert Ward ordered the drum beaten to call a boat from the other shore of a wide African river. In answer he saw a boat put out. In order to test the system he directed the beaters to announce that the boat was too small and to send a larger one. To his surprise he saw this done.

Erroneously, travelers thought that a code was employed in drum signals, but it is now found that a " drum language " was invented for the purpose. In the Cameroons, for instance, the language is well known, and sometimes the natives carry on a conversation by beating the language on the chest while the explorer is quite ignorant that something is being put over.

Another and most curious drum signaling is used by some tribes in South America. A diaphragm stretched on a wooden shell is sunk in the ground and a similar installation made in another village. Beating on one diaphragm causes particles of wood or leaves to dance on the diaphragm of the other, thus carrying the signals desired.

There is a widespread use of the drum in war, coming down from ancient times. First and last, bodies of soldiers have received orders by drum and whole populations roused to the threat of war.

In general, the information sent out by means of signals was conveyed through an agreed code which became the standard. Short cuts to language communuication gave rise to jargons such as pidgin English, Chinook jargon, and many others representing agreed simplifications which suggest the process by which a universal language may arise.

TELEVISION AS A FIELD FOR STANDARDIZATION

By C. Francis Jenkins, *Washington, D. C.*

It will come as a surprise to many that television needs but little standardization, as compared with motion pictures, for example.

In motion-picture theater entertainment all the theaters of the United States, and many of those elsewhere, are equipped with a choice of but three makes of picture projectors. But these are served with film made in many cameras by cameramen all over the world.

To insure the widest usefulness, obviously it was necessary that the common integral of the system, that is, the film, should be standardized, namely, as to width of film; size of picture frame; location of frame line; direction of picture-frame sequence; picture frames per second; and perforation of film (in shape, size, separation, location, and number per picture frame).

There were many other standards adopted for convenience and interchangeability, but none but film standards were absolutely necessary. Nor was time an element of consideration, for the film could be shown a day, a week, or a year after it was taken.

In television, however, time is the essence for the person or scene can be reproduced only simultaneously with its broadcast, the station being comparable to the camera in motion pictures.

At present there are only a relatively few radiovision broadcasters, and each follows his own inclination as to the elements which go to make up the treatment of his picture frame (scanned area). Some use as low as 24 lines per frame, some as high as 100 lines.

More television broadcasting is done (at the present time) on 60 lines per frame; 60 picture elements per line; and 20 frames per second than any other. The scanning is done from left to right and from top to bottom in successive lines, as one reads the page of a book.

The present method of television, as is now rather well known, consists of an analysis at the broadcast station, and a simultaneous synthesis at all receivers, of the person or scene, in successive elementary picture areas delivered over a single radio channel.

The resultant assembly of the elementary picture areas reminds one of the dots in a halftone printing block—coarse screen for newspaper work, fine screen for book printing—with its different sizes of dots, and which, assembled in groups of like sizes, make up the blacks and whites and halftones of the picture.

One can imagine these thousands of dots transmitted and received one by one in orderly succession over a radio channel. It will also be understood that the finer quality of picture, with its greater number of dots, or elementary areas, all sent in a small fraction of a second, one-twentieth for example, the higher is the frequency involved, and, therefore, the wider the radio band (in kilocycles), and that only. Therefore, standardization of picture frame, as already explained, is all that is absolutely necessary.

It is quite obvious that if television reception is to be enjoyed by everyone from all radiovision stations, then all stations must adopt a standard of analysis of the object or scene broadcast. Otherwise each household would have to buy a receiver for each

broadcast station, or limit its reception to the offerings of a single station. The sooner such standardization is accepted and practiced by all interests involved the sooner a large and enthusiastic audience will be nightly receiving television entertainment.

STANDARDIZATION IN THE COMMUNICATION SYSTEM OF RAILWAYS

By W. P. Borland, *Director, Bureau of Safety, Interstate Commerce Commission*

Various methods are in use for the communication of information between those responsible for the safe operation of railway trains in the United States. The two methods most commonly used consist of the display of fixed or movable signals of some sort, or the sounding of some form of audible signal, indicating the nature of the information which is to be imparted. The usual form of transmitting information from one place to another is by means of the telephone or telegraph.

Fixed Signals.—Fixed signals are signals located at a definite location, indicating conditions affecting the movement of a train. They may be of different types for different purposes, but their indications have been largely standardized through the cooperation of the organizations of the various railroads, and their meaning is uniformly the same throughout the country.

Block signals are one of the important means of conveying information to enginemen for the operation of trains. Several types are in common use to-day. One of these types is the semaphore signal which consists of a semaphore blade mounted on a signal mast and operated either by hand or by some motor-driven device. This signal displays its indication by the position of the blade by day, and, in addition, by colored lights at night. Some years ago the blade was commonly operated in the lower quadrants, but upper-quadrant signals have come into general use within the last 15 years and are gradually replacing the lower quadrant signals. The fundamental positions of the upper quadrant signals are horizontal for stop, diagonal (45°) for caution, and vertical (90°) for proceed. The usual colors displayed by night are red, yellow, and green for stop, approach, and proceed, respectively. Various combinations of positions of two or more blades and colors of lights are used for displaying aspects governing movements of a restricted character.

With the advent of higher speeds and heavier equipment it has been found that with the usual spacing of signals on the roadway the information given by the signal to the engineman was not always given at a point which would permit the train to be stopped before reaching the stop signal. This gave rise to a fourth indication known as approach medium (diagonal over vertical) which is used in connection with the three indications previously described. These 4-indication signal systems are used quite extensively on railroads where the speed and traffic density require the extra indication. On roads of lesser density 3-position signal systems are generally used.

Another type of block signal in extensive use is the color-light signal which has come into general use throughout the country, one advantage being the absence of moving parts. Light signals

have been used for many years in tunnels and subways, and following the development of special lenses and lamps their use has been extended so that now they are extensively used in the open country. The same color indication scheme is used as with the semaphore signals, the lamps, reflectors, lenses, and hoods being specially designed so as to permit the indications to be discerned as well by day as by night.

A third type known as the position-light signal is coming into use in some portions of the country. It consists of a row or beam of amber-colored lights indicating by position, similar to the semaphore signal, the condition of the block. This signal was designed to prevent the possibility of enginemen mistaking the color indication due to color blindness. The indications, in general, are the same as with semaphore signals. A limited amount of color-position light signals are in use with colored lights in the various positions.

In general, with all types of signals except the position-light type, red, yellow, and green are used for stop, approach, and proceed, respectively, corresponding with the horizontal, diagonal, and vertical positions of the blade in semaphore signals.

Other types of fixed signals in common use on railways consist of (*a*) crossing signs at highway crossings, marking the location of crossings; (*b*) crossing signals, indicating to highway travelers the approach of trains, such as bells, flashing lights, wigwags, and gates, the aspects of which are standardized; (*c*) clearance signs at points where the clearance between moving trains and structures is limited, for the safety of employees; (*d*) speed restriction signs indicating to the enginemen speed restrictions in effect at various points; (*e*) yard-limit signs indicating to operating crews the extent of a yard; (*f*) stop signs at noninterlocked railroad grade crossings; and various other signs imparting information as to the operation of the railroad or for the protection of the public.

Movable Signals.—Principal among the various movable signals used on the railroads are flags and lamps.

Flags of different colors are used by day and lamps by night to indicate various conditions.

Green flags are used by switchmen in signaling enginemen relative to the movement of trains over hand-operated switches. They are also used on locomotives to indicate a following section, or on the roadway as resume-speed signals.

Yellow flags are used under some conditions as rear-end markers of a train, slow-speed signals over sections of track, or at other points where caution is to be observed in the operation of a train.

Red flags are used for flagging approaching trains or under any conditions which involve danger in the movement of trains; also as markers on the rear end for trains on main tracks; and stop signals at block stations for the delivery of train orders.

White flags are generally used on extra trains to indicate their classification.

Blue flags are used in and around yards to indicate men working on cars and to provide for their safety while so engaged.

Lamps of similar color are used by night in lieu of flags by day and have the same meaning.

Train Orders.—Two standard forms of written train orders are in general use for the purpose of transmitting information governing the movement, meeting, and passing of trains. One of these forms (form 19) does not require the signature of train crews; and is generally used when an order does not restrict the rights of the train receiving it; when the rights of trains as conferred by time-table or class are restricted, form 31 is used, and this requires the train crew to sign for its delivery. Train orders are written in multiple, and in order that everybody concerned may have the same information and interpretation, standardized forms of wording, forms A to S are in common use. The matter contained in these forms is short, concise, and clear as to how the movement is to be executed.

Clearance cards of two forms, Form A and Form B, usually accompany the train orders, and indicate their numbers and reason for their issuance, thus insuring that all copies are delivered. Like the train orders, their wording is standard and they are universally used throughout the country.

Whistle Signal.—Engine whistle signals of standardized code are employed for indicating to employees, other trains, or the public certain conditions arising in connection with the operation of trains. They are used either with the train standing or running, and their meanings under these conditions are in accordance with codes printed in the rule book of each railroad company.

Communicating signals are employed for communication between the train crews and engine crews, each having a separate meaning as to the operation of the train, brakes, station stops, emergency stop, meeting points, and other similar conditions. Like the engine-whistle signals, these are standardized on all railroads.

Telephone and Telegraph.—These devices have been in general use for many years for the transmission of train orders for train dispatching, transmitting messages and orders, and other information. The telephone has to a considerable extent supplanted the telegraph for transmission of train orders, more than 60 per cent of the orders now being transmitted by telephone.

THE STANDARDIZATION OF LANGUAGE

By Thomas A. Knott, *the General Editor of the Merriam-Webster Dictionaries*

Language, consisting of words of various functions, usually interconnected and arranged in a purposive order in sentences, and uttered with an intonation that directs them to their purpose, has apparently, from the most primitive stage of human society, been a highly conventionalized instrument for the conveying of emotions, thoughts, information, commands, and questions. Its very function has required conventionalization, for the conveying of a thought or a command from one consciousness to another demands that the word or sentence should possess the same (or nearly the same) meaning for the hearer that was intended by the speaker.

There is, however, an almost incredible distance between the merely conventionalized speech of a tiny, isolated, illiterate clan of hunters or nomads or crop raisers and such a standardized international language as Latin or Arabic in their day or English or

Spanish to-day. This distance has been bridged by certain steps that may be outlined (not always in a strictly chronological order) as follows: (1) The growth of moral conduct, resulting in security for life and property; (2) the development of industry, business, and commerce; (3) the creation and distribution of wealth; (4) the more general attainment of leisure; (5) the spread of education, resulting in the social freeing of potentially brilliant leaders; (6) the development of literature and the arts; (7) the study and application of science; and (8) the development of communications, especially the development or creation of the road, the ship, the railway, the printing press, the telegraph, and the radio. Most of these steps, however, are merely prerequisites. The really essential factors are education, literature, the printing press, and easy transportation.

Easy transportation, with the resultant constant moving about and general intermixture of nearly the whole population, is the basic reason for the general uniformity of pronunciation throughout the United States and Canada, so that it has even been said (in spite of some slight peculiarities in the Northeast and Southeast) that there are no dialects in this country. During the period when our population has been growing from 3,000,000 to 120,000,000—a century and a half—there has been hardly a child who grew up without changing many or most of his playmates, either through moving himself into a new neighborhood or State (often more than once) or through the moving of his friends. Since most individuals form their pronunciation habits before they are 15 years of age, through imitation of their associates, this generalization of personal contact has caused a great leveling out of local speech peculiarities.

Another factor of the greatest importance has been the public school with its accompanying agents of instruction—the teacher and the textbook. It is impossible to overestimate the influence of such books as McGuffie's readers on the common vocabularies and ideas of the pupils, or of Noah Webster's blue-backed spelling book on their spelling, or of the school dictionary on their understanding of meanings and on their common pronunciation during the formative period of our national life.

A third contributing factor has been the low-priced newspaper and magazine, both of them for the most part using language of a high type and dispensing floods of information of great value in increasing our common stock of words and information. As a result chiefly of the influence of these factors, the standardization of the language of the United States and Canada during the last three centuries has been one of the most astounding phenomena in all the history of language. One hundred and thirty million descendants of Britons, Irish, French, Dutch, Germans, Spanish, Scandinavians, Russians, Italians, Poles, Finns, Lithuanians, Greeks, Syrians, and American Indians are to-day reading, and to a reasonable extent speaking and writing, the language of Thackeray, Dickens, and Hawthorne. Contrast this with what happened within a few centuries (possibly only five) to the various branches of the Indo-European speech when it was carried by migrating little tribes, of a few thousand persons each, from eastern Europe to India, Greece, Italy, and Scandinavia, to become such mutually unintelligible languages as

Sanskrit, Greek, Latin, and Gothic. The explanation is obvious. The groups of Indo-European migrants lived isolated from one another and without the conservative influence of a written (or printed) literature.

So much for the language as unconsciously acquired. But when it comes to the realms entered in the higher schools and the professions, the situation is strikingly different. Here we meet subjects and sciences like mathematics, chemistry, psychology, and botany, more than a score of them, each one with a highly conventionalized or deliberately standardized vocabulary of its own, achieved as a result of centuries or decades of careful, exact thinking, and efforts at the most precise expression. The younger and less explored the field of a science, it is true, the more likely its terms are to change their meanings. Sine, hydrogen, obovate, however, are settled, whatever may result from our latest explorations into parallel lines, atoms, behavior, or cells.

Nor can too much credit for standardization on a high level be given to the deliberate, conscious labors of the continuous stream of professional writers, from Chaucer to the latest bud of a novelist. From generation to generation they have learned the methods and achievements of their predecessors, and each generation has added its contribution to the style and technique of both poetry and prose. The effect of their work is cumulative. We still read Shakespeare, the King James Bible, Addison, Swift, and Fielding, and model our language on theirs in both speaking and writing. This is one result of the miracle of the printing press, with its low-priced product. Five hundred years ago, in the day of the hand-written manuscript, a 300-page book cost the equivalent of $750.

To-day, in the industries and sciences, especially in some where the terminology has been especially chaotic, we are witnessing a new kind of deliberate effort to secure standardization. Paint, textile, and dye manufacturers are groping their way toward agreement on the meanings of names of colors, although not officially. The Anatomical Society has adopted nearly 5,000 terms (all in Latin), covering practically every term used in human anatomy. The International Botanical Congress has adopted an International Code of Botanical Nomenclature (devoted to scientific names only). The National (American) Advisory Committee for Aeronautics has adopted nearly 500 official terms and definitions. The International Research Council and the National Academy of Sciences have published the International Critical Tables for Numerical Data, Physics, Chemistry, and Technology. The Society of American Foresters has published Forest Terminology, with more than 1,800 definitions; and committees on nomenclature are active in many other associations.

What has been said above, however, about the changing meaning of such terms as atom and cell should warn us against too much confidence in the possibilities of achieving absolute or permanent standardization. Highly valuable as most of the work of standardizing terms has been and will be, we must remember that our scientific vocabulary can be fixed with complete finality only when our sciences no longer have anything in their fields to be investigated or discovered. The same observation may be made on all the other

phases of our practical and intellectual life. The meanings of many words, such as matter and heat, were thoroughly understood 25 years ago, and to-day nobody understands them. When some of us were boys there were no airplanes; there was only Darius Green and his flying machine. There were no radios or automobiles or garages. Not long since I overheard a 10-year-old boy in an old-fashioned New England village, especially preserved near Springfield, Mass., say to his father, "What is a blacksmith shop for?"

Our civilization and our language are changing.

STANDARD MEANS OF COMMUNICATION FOR DEAF MUTES

By Josephine B. Timberlake, *Superintendent, The Volta Bureau, Washington, D. C.*

The means of communication in use among the deaf depends to a considerable extent upon whether their educators permit them to remain mutes. Earlier generations, in the belief that speech was impossible for them, taught them to transmit ideas in signs, and thus developed a sort of language, crude and incomplete, but very useful among the few who understood it. This sign language does not follow the order of words of any spoken language, but is rather a series of pictures, usually supplemented by words spelled on the fingers. At one time all schools for the deaf in this country taught it, but now it has been discarded as a means of instruction, and many schools prohibit its use entirely, for the reason that the use of a language of gestures tends, like the use of slang, to restriction of the vocabulary and to inability to express ideas with discrimination. It is still widely used for conversation, however, especially among the older deaf persons, and before audiences so large as to render lip reading difficult or impossible.

By the use of finger spelling, words in any language may be communicated. In this country, and for the most part in Canada, the one-hand alphabet is that most commonly used, but in Europe a two-hand alphabet is preferred. Either is readily learned, and practice enables the user to attain considerable speed, not greatly inferior to the speed of average speech. In many schools for the deaf a few classes, made up of children who have not progressed satisfactorily in the use of speech and lip reading, are taught by means of finger spelling. These children, of course, remain mute all their lives.

The oral method, which uses speech and lip reading as the means of communication, is the leading method employed for the deaf by modern educators. Many schools depend upon it entirely, and all but two or three give it classroom preference. Modern opinion holds, therefore, that the standard means of communication for a deaf person is the language of the country in which he lives. If he has been well taught from an early age, he can probably speak it intelligibly, and can understand those about him by reading their lips. Or, if he fails in these, he can communicate readily with the help of pencil and paper. Contacts, not only with his relatives and friends, but also with employers and fellow workmen, are thus much easier for him. He is not restricted to the companionship of those who have learned a manual alphabet or the sign language.

The best lip reader in the world, however, can not understand a speaker who mumbles, or speaks with a rigid jaw, or distorts the motions of his lips. The best way of completely standardizing his means of communication, therefore, is to promote a standard of clear, pleasant, intelligible speech throughout our population.

STANDARDIZATION IN MILITARY COMMUNICATION

By Capt. Fred G. Borden, *Signal Corps, United States Army*

Probably in no form of human activity is standardization more essential than for military organizations. Wars usually occur suddenly and without warning. After war is declared there is no opportunity to arrive at logical decisions as to training, equipment, and similar matters. These must be decided in times of peace when time is not so vital and when opportunities permit.

The Signal Corps is charged with the purchase, storage, and issue of all items of signal equipment for the Army which are of a commercial type, and is also charged with the development, purchase, and issue of noncommercial types of communication equipment not only for its own use but for the use of all other arms and services. Perhaps an example of the methods followed in perfecting a new type of communication equipment might be of interest. We will assume that it becomes apparent that a motor vehicle capable of laying and recovering field wire has become necessary. This vehicle will be used not only by the Signal Corps, but by the Infantry, Field Artillery, Cavalry, Coast Artillery, and, perhaps, other arms. A study is made in the office of the Chief Signal Officer to determine the necessary characteristics of a vehicle which will most nearly fulfill all of the requirements of the various using arms. A tentative set of military characteristics is compiled and copies forwarded to the chiefs of the using arms for their comments and recommendations. The chiefs of the arms usually submit this tentative list of military characteristics to their respective service board composed of officers of long experience, and the duty of each board is to examine the characteristics of the vehicle from the standpoint of its use by their particular arm and to forward the board's recommendation to its chief of arm who furnishes a copy to the Chief Signal Officer. After all of these recommendations have been received they are coordinated and the military characteristics of the vehicle are revised to include such changes as seem practicable and necessary. Vehicles of the revised type are then obtained and sent to the various using arms to permit extended service tests in the field. The results of these service tests are included in reports which reach the Chief Signal Officer through the chiefs of the respective arms, together with their recommendations. Very possibly some minor changes are recommended and these are again coordinated by the Chief Signal Officer and additional vehicles obtained including, as far as practicable, the recommended changes. Frequently these are again given a thorough field test to insure that they will reasonably fulfill the military requirements. Detailed specifications are then prepared and submitted to the War Department for final approval and for the adoption of the vehicle as a standard type. The vehicles are then purchased in quantity, within limits of funds available, and issued to the using arms.

While the procedure described might be considered as requiring too many steps, yet the necessity for providing an article which we may be confident will perform its necessary function during the various phases of combat will not permit of any considerable curtailment.

Standardization is essential not only to insure the suitability of the particular piece of apparatus but from other standpoints as well. For example, wire communication in combat units is usually furnished by means of twisted-pair insulated wire laid on the ground, since this is the only type of construction that time will permit. Wire used for this purpose must have certain characteristics which are not necessary for wire used for commercial purposes. For example, the wire must lay flat on the ground to permit foot troops and vehicles to pass over it easily. Furthermore, the wire must have sufficient tensile strength to permit its being laid from a rapidly moving animal-drawn or motor vehicle without the probability of its breaking under a sudden strain. In order to fulfill these requirements the conductors must be composed of strands of fine wire of a special type of steel. A study which has been made indicates that there are not enough stranding machines in the entire country to furnish the amount necessary for our needs in the case of an emergency. Under these circumstances another type of wire which is used commercially and which can be readily obtained must be adopted as a substitute standard, in spite of the fact that it does not entirely fulfill the above requirements. This commercial wire is used to supplement the supply of standard wire.

There are two entirely different methods which might be followed in developing a standard type of communication equipment: The first is to base the standard on performance specifications; the second, by definitely designating the exact size, weight, and other characteristics of each individual part, on detailed construction specifications. As an illustration let us consider a radio set. By completely designating the size and weight of the set, its required range, the frequency on which it will operate, the type of signals which it will emit, etc., it is possible to obtain, under performance specifications, sets with identical performance characteristics. Such sets can communicate with each other and to this extent might be considered as standard. In practice, however, the results are unsatisfactory, since by law the Signal Corps is obliged to buy equipment from the lowest responsible bidder. Performance specifications might be satisfactory if only one order were ever contemplated, for in that case all sets would be identical in all component parts. Should, however, an additional quantity of a similar equipment later become necessary it might be found that a different concern is the lowest bidder and, therefore, receive the contract. His product would meet all performance requirements, but the component parts would not be interchangeable with the components of the sets originally purchased. A single set of instructions for the operation and maintenance of the two differently constructed sets would be impracticable and the time required to train personnel for such operation and maintenance would be greatly increased. On the other hand, provided complete detailed construction specifications, including drawings of each component part, are furnished to bidders the product of one factory will be identical with that of another, and any component part of any set may be substituted for a defective part of any other set of the same

type. Also the problem of training is greatly simplified. The preparation of detailed construction specifications for such a complicated piece of apparatus as a transmitting and receiving radio set requires many weeks or even months of effort by highly qualified technical experts, and the time required to complete the development of such a set is necessarily considerably increased, but by this latter method only can the Signal Corps be assured that its communication equipment for war will be standard in every sense of the word.

During peace times the Signal Corps is responsible for the operation of post telephone systems, radio stations in the Army and corps nets, and similar peace-time activities. As regards wire communication, the policy is to follow the best commercial practices. These practices are standard throughout the United States and have been evolved after many years of research and actual functioning. Standards, as adopted for use in connection with the installation and maintenance of peace-time radio sets, have been worked out partly by following the latest commercial developments and partly by experience gained by the Signal Corps in the actual operation of extensive radio nets.

The above discussion refers to matériel only, but in the Army it is necessary that standardization be effected for personnel as well. The large number of men involved, the necessity for immediate action, and the requirement that a military organization act as a unit necessitates standardization of the men who compose the organization. This is usually termed " discipline," but, since the object of discipline is largely to insure that different men will react to similar orders in a similar manner, the effect is standardization pure and simple. From a communication standpoint radio operators are standardized as regards speed and the use of certain specified code signals. Telephone operators are taught a standard method of operation for the various switchboards. It is undoubtedly true that standardization of personnel is more nearly universal throughout a military organization than in any civilian activity.

STANDARD CONTROL OF THE ACOUSTICS OF AUDITORIUMS

By Paul R. Heyl, *Chief, Sound Section, Bureau of Standards*

The scientific study of architectural acoustics is of comparatively recent origin. In 1895 Harvard University had just completed the Fogg Art Museum, containing an auditorium which proved almost unusable. Prof. W. C. Sabine, of the Harvard faculty, spent two years in an investigation of the questions involved, in the course of which experiments were made in a number of existing satisfactory auditoriums. As a result certain fundamental but unrecognized principles became clear, which later enabled Professor Sabine to predetermine the acoustic design of the new Boston Symphony Hall.

These investigations by Sabine were the pioneer scientific work in the subject. So completely and carefully were they carried out that subsequent workers have done but little in the way of extending the theoretical foundations of the subject, but have for the most part

merely enlarged our knowledge of the acoustic properties of the various materials commonly used in building construction.

The most common defect in auditoriums is excessive reverberation. A sound produced in a room is reflected back and forth from walls, floor, and ceiling, a portion of the energy being absorbed at each reflection until the intensity is so reduced that the sound becomes inaudible.

Owing to the high speed of sound (about 1,100 feet per second) there will be many such reflections per second in a room of ordinary size, and the greater the dimensions of the room the more prolonged will be the reverberation.

If the reverberation is unduly prolonged, one syllable or note of music will blend with perhaps half a dozen that follow it, interfering with proper hearing. The reverberation time must be kept down to a minimum. It is not advisable to do away with reverberation altogether, as this makes a room oppressively "dead." Our established auditory tastes and habits require a small amount of reverberation for an acceptable effect. This amount is found to increase with the size of the auditorium.

Reverberation may be kept down by covering the ceiling or walls of the room with some material which is more absorbent of sound than ordinary plaster. It is not generally realized that ordinary plaster is a better reflector of sound than a silvered mirror is of light. It is a good mirror that will reflect 95 per cent of the light that falls on it, while a plastered wall may reflect 98 per cent of the sound incident upon it. With such a low absorbing power a sound wave must be reflected back and forth a great many times before it becomes inaudible.

Sound-absorbing materials must be porous enough to blow through. When the compressed air of a sound wave meets such a substance the air is forced into the pores, where by friction its motion is converted into heat.

The earliest sound absorbents used were fibrous materials of a vegetable or animal origin, such as hair felt. At the present time rock wool, a fibrous material made from blast-furnace slag, forms the basis for several types of material. Acoustic plasters and artificial stone are also on the market.

The acoustic laboratory of the Bureau of Standards is continually called upon to make measurements of sound-absorption materials, and its results are available for the public Letter Circular No. 308, which may be had free on application.

It should be emphasized that good acoustic qualities of an auditorium can be secured at the time of building, and that it should not be necessary to go to the extra expense of correcting reverberation after a building is completed, except in the case of an old structure. The principles of architectural acoustics are not difficult and are explained in Bureau of Standards Circular No. 396, entitled "Architectural Acoustics," which may be obtained of the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of 5 cents (stamps not accepted).

STANDARDIZED SIGNS AND SIGNALS TO PROMOTE HIGHWAY SAFETY

By M. G. Lloyd, *Chief, Safety Section, Bureau of Standards*

Much of the traffic in the streets of any city is not local but interurban, interstate, or possibly of still more distant origin. If vehicle operators are to be expected to comport themselves in conformity with local regulations and practices, those regulations and customs should be substantially uniform in all municipalities.

Modern control and regulation of street traffic, to be efficient, involves the use of such mechanical helps as traffic signals, signs, and pavement markings. The use of such devices has been developing rapidly in recent years. City traffic has become so complicated and restrictions have become so numerous that it is necessary for drivers of vehicles to receive an almost continuous series of instructions not to violate regulations and thus interfere with the use of the streets by others.

The necessity of controlling traffic at intersections was first met by stationing a traffic officer to personally direct the movements of vehicles. To perform this function more easily he was provided with mechanical semaphore signals operated manually to stop traffic alternately upon the two intersecting thoroughfares. For use after nightfall, such apparatus was provided with lanterns of some type, the color of the light carrying the intended message. The desirability of coordinating form, color, number, and lettering in giving signals to an indiscriminate succession of drivers, who may include the illiterate, the deaf, and the color blind, is obvious.

STANDARDIZATION IN THE POSTAL SERVICE

BUREAU OF THE FIRST ASSISTANT POSTMASTER GENERAL

Post Office Service.—For the past two years the department has endeavored to standardize, in so far as practicable, all post office methods and system and the various postal services rendered the public. Particular attention was given the carrier delivery and collection services at the 55 largest post offices where surveys were conducted.

Prior to these surveys the number of collections from mail boxes located in the business and residential areas and the frequency of delivery of mail by carrier in the large cities was not uniform. As a result of the surveys both the collection and delivery services have been standardized, careful investigation having shown that four deliveries by carrier in the business districts of the large cities, three in the semibusiness districts, and two in the residential districts were ample to meet the needs of the patrons of the service. In the offices at which surveys were made, carriers were scheduled to return to the post office, bringing with them all mail collected from boxes located in their delivery districts in time to permit the delivery of mail so collected on the afternoon of the same day. This rearrangement of schedules resulted in effecting deliveries in the afternoon throughout the entire postal areas of the large cities of mail collected in any locality of the city in the morning.

For mail-collection purposes the various cities were separated into what might be termed "collection zones." The first zone embraces the business district, where necessity exists for frequent col-

lections. However, most of these collections are made by foot carriers in connection with their regular deliveries. But where the volume of mail collected is too great for the carrier to bring personally to the post office, such mail is deposited in large collection boxes, located in convenient places, to be collected by vehicles making frequent trips to the post office.

Special collections have been provided to take care of mail originating in the factory and outlying business sections between 4.30 and 6 p. m.

In the residential sections of the large cities, unless unusual conditions exist, three collections from boxes are regarded as sufficient, the first two (morning and afternoon) by the delivery carriers, and the third, a clean-up collection, by mounted collectors, between the hours of 8 and 9.30 p. m. Of course, if all the important mail trains leave a city earlier in the evening, this last collection is made at an earlier hour, and where it is demonstrated that there is an urgent need for an additional late night collection or an early morning collection, necessary authorization is given.

While, as stated above, surveys were only made at the 55 largest post offices, nevertheless, the methods found to be advantageous at such offices are being applied with satisfactory results at all post offices in so far as practicable.

Rural Delivery Service.—The first rural delivery service was established effective October 1, 1896, and in the years immediately following that date its growth was rapid. A very large proportion of the routes were arranged before roads were generally improved and when horse-drawn conveyances were the usual means of travel or transportation on the highways.

By reason of the conditions existing in the earlier period of the rural delivery service many routes of short length were established and even on such routes the carriers were required to expend 8 or 10 hours a day in serving them. Since the advent of hard-surfaced roads and the general use of motor vehicles by the rural carriers an unsatisfactory condition from an administrative viewpoint has existed in that the carriers have been employed not to exceed 2½ to 4 hours a day.

To meet this situation, the department adopted the policy, effective October 1, 1925, of making consolidations of rural routes as vacancies in the rural carrier force occur. From the date of the adoption of the policy to the present nearly 3,800 of these consolidations have been made, with the result that not only has the cost of operation been materially reduced but the hours of work required of the carriers made more nearly equal to those of other employees in the Postal Service. These consolidated routes are from 40 to 80 miles in length, there being more than 2,700 that are more than 50 miles long, and the service on them is performed with regularity, the facilities afforded the patrons not being injuriously affected by the lengthening of the routes.

BUREAU OF THE SECOND ASSISTANT POSTMASTER GENERAL

Air Mail Service.—The development of mail transportation has followed closely the advances in methods of available transportation, and successively there has been established service on foot by man,

on horseback, by horse-drawn vehicles, boat, railroad, automobile, and airplane; speed in transportation coupled with safety and security being the object in view. The latest development, that of airplane transportation, was inaugurated only after the most careful experiments were conducted and concentrated effort made to demonstrate its practicability. The present air mail service, the actual operation of which is by private interests under contractual relation with the Government, presents a means for rapid transportation that commends itself to the public and is rapidly being recognized as a necessary form of transportation of mails by the progressive business interests of the nation. The proportion of loss being a fraction of 1 per cent gives it a position among the methods of safe and secure transportation, which is well worthy of patronage.

The efficiency of the service, aside from temporary interruptions, that may occur on account of bad weather conditions, depend upon the arrangement of the schedules and it necessarily follows that the department alone is in position to coordinate the operation of the various routes to accomplish that purpose. In doing so it takes into consideration the peak loads at terminals on the transcontinental routes and adjusts the so-called feeder routes to make the most advantageous connections. At times, on account of lack of lighted airways at some points, it has not been practicable to arrange a schedule which would permit of a late evening departure and connection would then be made with a daylight flight which would provide a service somewhat less convenient, but would expedite the delivery of the mail. The operating company is consulted as to available equipment when flights involving night flying are contemplated, but the department arranges the schedule time, which is dependent upon the exigencies of the service, and the rates of flight vary from 90 to 140 miles per hour, with an average of approximately 106 miles per hour, the variance being due to flying conditions, terrain, and equipment required. The frequency of service naturally is determined by the quantity of mail offered and is adjusted to the time of day when the volume warrants the additional service.

The frequency varies from one round trip a day over the whole route to four times a day, and where a connecting route has less frequent service the departing plane thereon is scheduled at such time as may be necessary to receive all the mail that can be advantageously dispatched. For instance, between New York and Chicago, planes are scheduled to depart from the New York terminal at 9.15 a. m., 12.15 p. m., 9.20 p. m., and 10.15 p. m., and to arrive at the Chicago terminal at 3.47 p. m., 7.02 p. m., 4.17 a. m. and 5.12 a. m., respectively. On the connecting transcontinental route to San Francisco and the west coast, the planes are scheduled to depart from the Chicago terminal at 4.30 p. m., 12 p. m., and 8.45 a. m. The westbound mail from the 9.20 p. m. and 10.15 p. m. planes from New York due in Chicago at 4.17 a. m. and 5.12 a. m., respectively, is continued toward destination on the 8.45 a. m. plane from Chicago.

During the inception of contract air mail service, with two exceptions, the compensation to the contractors was computed on a basis of air mail postage involved. That method of payment was early determined to be too cumbersome for a growing service and legisla-

tion was requested and obtained to provide payment on a poundage basis. Advertisements thereafter were issued for proposals on that basis and resulted in a variation in rates that determined its unsuitability as a standard for payment and resulted in the enactment of the present legislation which provided payment at rates per mile instead of rates per pound, and authorized the Postmaster General to issue route certificates, at rates to be fixed by him from time to time, at least annually, to the contractors at that time.

The present legislation, involving the setting up of new rates and periodic adjustment thereof, required a knowledge of the costs of operation. To establish a basis of payment, conferences were held with the various contractors and data obtained from them which was thoroughly investigated by the department, and a formula was adopted on May 1, 1930, beginning with 12.5 cubic feet of space and 200-pound weight units at 55 cents per mile with allowances of variables of 2 cents for terrain, 2½ cents for fog, 6 cents for radio and 1½ cents for two to five passengers. The formula also provided for units up to 125 cubic feet with a weight unit of 2,000 pounds and for passengers up to 30 and over and for operation of multimotor planes.

A development of the determining of the rates mentioned was the establisment of a uniform system of accounts for carriers by air which is prescribed by the Post Office Department for all air mail carriers, and the keeping and maintaining of which has been enthusiastically followed by them. As a result of its establishment a reduction has been made of approximately 5½ cents per mile, and such further adjustments will be made as the accounts of the carriers may warrant.

Cost Ascertainment.—The cost ascertainment system of the Post Office Department has for its foundation the establishment of standards from which there may be computed, in connection with each of the classes of mail matter and each of the special services, the revenues, the direct and apportioned expenditures, and the resulting gain or loss, not taking into account, with respect to expenditures, relative priority, degrees of preferment, and value of the service rendered.

Such standards are established from 7-day tests conducted at intervals of approximately three months.

In recognition of the varying conditions at the particularly large post offices, each of the 15 largest post offices is treated as a separate unit.

First-class post offices, other than the 15 largest, are divided in the cost ascertainment into five units, according to annual receipts. Second class, third class, and fourth class post offices are each treated as separate units. From each of these eight units there are designated annually such number of post offices as may be deemed sufficient to produce data fairly representative for all post offices in that unit.

The post offices designated as cost ascertainment offices produce approximately 50 per cent of the gross revenue of the Postal Service.

Separate standards are established for each of these 23 units, which are in turn applied, in the form of ratios, to the audited

revenues for the year by sources, and to the operating expenditures for the year by appropriations, for each unit.

Similarly, tests are conducted in the Railway Mail Service during each of the four 7-day statistical periods for the purpose of establishing standard ratios to be used as bases for the allocation of the operating expenditures from the several appropriations of funds for the conduct of that service.

Such tests are regularly conducted in a definite and uniform proportion of all the railway post office lines of each grade in each of the 15 divisions of the Railway Mail Service, in 12 of the larger terminal railway post offices, and in a representative number of the smaller terminal railway post offices.

During the course of these statistical periods data are collected in each of the several units of the post office and Railway Mail Service from which there may be computed in connection with each class of mail the number of pieces, the weight, the volume in terms of cubic feet, and the average haul. Such data are gathered not only for statistical purposes, but also for use, either singly or in combination, in the allocation of certain expenditures.

Statutory changes in classification of mail matter and postal rates, in postal salaries, and in other scales of expenditures, coupled with changes in methods of advertising and merchandising by patrons of the Postal Service, make necessary, from the standpoint of accounting, the establishment of new standard ratios each fiscal year.

Motor Vehicle Service.—Standardization in the motor vehicle service has developed along the following lines: (*a*) Standard Federal specifications for materials are adopted as fast as promulgated; (*b*) standard instructions are now in use for servicing and lubricating trucks; and (*c*) method of assembling and disassembling trucks and in overhauling, including machinery required incident to work of this nature, has been standardized so that the same methods are followed generally throughout the country.

While automobile chassis are purchased under standard specifications, it has not been possible for the department to standardize on motor vehicles, except as to capacity. As, for example, it may be stated that substantially the same specifications have been used under the last three advertisements for the 1,800-pound gross-load carrying capacity chassis. Under these specifications, however, awards have been made to three different automobile manufacturers on the last three advertisements, so that there is little or no possibility of standardizing under these conditions.

Post Office Scales.—The Post Office Department has standardized on the following capacities of scales: 9-ounce beam scales (for weighing letter mail); 4-pound beam scales (for weighing first-class matter in excess of 9 ounces); 70-pound automatic indicating scales (for weighing parcel post in offices of the first and second classes); 100-pound beam scales (for weighing parcel post in offices of the third and fourth classes); 500-pound platform scales (for weighing sack and bulk matter); 2,000-pound platform scales (for weighing sack and bulk matter); and 10,000-pound built-in platform scales (for weighing hand truck loads of mail).

With a view to eliminating doubt by clerks in post offices accepting mail as to whether additional postage should be paid, the 9-ounce

and 4-pound scales are now being purchased with an indicator and trig loop which readily shows when the beam is above horizontal and additional postage should be paid. Because of the many advantages of the indicator and trig loop in these capacities of scales they have been standardized as better meeting the needs of the department than the old style scales.

With a view to procuring better scales and standardizing on the method of determining when the pivots and contacting parts are of the proper hardness the Bureau of Standards was consulted, and as a result thereof there has been incorporated in the specifications a clause to the effect that all pivots must show a Rockwell hardness number of not less than 60 on the " C " scale and all contacting parts must be as hard as the pivots. Prior to the standardizing on the hardness of these parts there was no satisfactory method of determining when they were of the proper hardness and whether the hardness was uniform.

Additional information concerning recent developments in the standardization of commodities by the Post Office Department is given in Chapter V, p. 141.

STANDARDIZED COMMUNICATION AIDS TO MARINE NAVIGATION

By T. V. O'Connor, *Chairman United States Shipping Board*

Communication aids to navigation involve a source, or sending station, and a receiving station. In marine navigation the ship is the receiving station. In some cases the sending station is also on a ship. This article considers principally the ship and the means of communicating information and receiving it on the ship, as an aid to her safe navigation.

Before the coming of radiotelegraphy the available means of communication between ships at sea, and to or from the shore, could span but a short distance. They are all based on sight or on sound and are inefficient at best. Under some conditions of frequent occurrence they are uncertain, unreliable, or they fail altogether. Radio communication, and the systems of position-finding combined with radio, are the greatest known aids to marine navigation and to increased safety at sea. This is worth remembering when a broadcast program is cut off in order to render service to a ship at sea in distress and for the saving of the ship and human life. Radio communication for this purpose, and for communication with and between vessels at sea, was developed and was in regular use before the days of broadcasts. There is no known substitute that can render the same service to ships.

Visual communication systems that may be used and are used at times as aids to marine navigation include flag signals, semaphore signals, shape distant signals, and flash signals.

Flag signals have, no doubt, been used since very early times. A number of sets of flags and corresponding code books for communication with ships were devised and issued privately during the first half of the nineteenth century. Some of these were used generally by the ships of different nations. These flags and codes were superseded by an improved code issued by the British Board of Trade in 1857, which in turn was replaced by the International Signal Code

adopted by the conference in Washington in 1889. That code was not completed and issued until about 1897.

The last revision of the international signal flags and code was made by the International Radio Conference, held in Washington in 1927. It is not expected that its code can be issued and brought into use before 1934. This revision is a great advance in that it provides for 40 signal flags, for a greatly increased number of signals, for code books in 7 languages that are being worked out to be truly international, and for standard forms of messages and call letters generally in conformity with the rules for radio communication.

This last revision will abolish distant signals made with shapes instead of flags, also fixed semaphore signals, as no longer necessary with radio communication available. Semaphore signals with small flags in the hands of the signal man are retained for communication over short distances. The international Morse code is used.

Flash signals are made, day or night, with a beam of light. Signal lamps serve for short distances; signal searchlights for longer distances. The international Morse code is used for these signals.

Another class of visual aids to navigation is lighthouses, lightships, beacons, and buoys. While no message is transmitted, the mere sighting of one of these objects and its identification on the chart, provide a fixed point that may be used to plot or to judge the position of the ship. Lighthouses and lightships, also many beacons and buoys, are lighted at night. Thus they are useful whenever the visibility is good enough for them to be seen. The marking and the character of the lights are arranged for identification.

Sound signals include whistles, sirens, foghorns, bells, gongs, oscillators, and other apparatus for producing sound. Lighthouses and lightships are fitted to sound definite sound-in-air fog signals. Some lightships, in addition, give fog signals on submarine bells or oscillators for producing under water sound signals.

Submarine or under water sound signals are sound vibrations produced under water by bells or by an oscillator. The latter has a much greater range than the bell, and both have greater ranges and greater reliability than sound-in-air signals. The receiving apparatus now installed on the vessel requires trials on different headings to determine the bearing of a submarine signal when heard.

Radio aids to navigation include, in addition to the information furnished by messages, other services such as radio compasses, radiobeacons, and synchronized radio and submarine signals. A synchronized radio and sound-in-air signal has also been developed.

Radio-compass stations are direction-finder stations permanently established on shore, either singly or connected in groups of two or more. Standard procedure is established for a vessel to ask by radio for bearings and to receive from the control compass station her bearing from each of the stations able to observe.

Radiobeacons are stations on shore, or on lightships, that broadcast signals. The ship determines her position by taking the bearing of two or more radiobeacons by means of a direction finder; that is to say, a radio compass installed on the vessel. The position may be found from two bearings on the same beacon and the course and distance run between bearings, the same as from visual bearings for lighthouse or other object in a known position.

The synchronized radio and under water sound signal enables the distance of the vessel, from the known position of the oscillator producing the submarine signal, to be determined at the same time and with the same radio signal that is used to determine the bearing of the radiobeacon by means of the direction finder. This gives at once the position of the ship within the accuracy of the apparatus.

There is another modern aid to navigation that, while not depending on communication from without the ship, is so important in itself, and in conjunction with the visual aids and the radio aids, that its mention should not be omitted. It is the fathometer, an apparatus for echo depth finding. This instrument measures the depth of the water under the vessel and thus gives the sounding to compare with the soundings on the chart and, in conjunction with the other methods, shows the ship's position. Its usefulness is increased by the readiness with which it can be used, even to show the depth continuously and without reducing speed to take soundings.

Distress signals, as used by all classes of vessels, may utilize the means of communication already described or may be peculiar to the purpose. Thus flames, as from a burning tar barrel on deck, a gun fired at frequent intervals, a rapidly flashing light, rockets, or Roman candles are all used as distress signals, and are universally understood to mean that the vessel requires immediate assistance. An interesting form of distress signal, recently placed on the market, is particularly valuable on power boats and small yachts, many of which have their decks but a few feet above the water and are not equipped with radio sending apparatus. This consists of a pistol which fires a brilliant flare attached to a small parachute. By shooting vertically upward the flare is suspended at a great height above the boat and lasts for a minute or more. The chance that such a flare will be seen on shore, even at a distance of several miles, is much greater, of course, than if it was burned on the deck of the boat.

Standardization of the apparatus used in connection with communication aids to marine navigation has not been attempted, and is not now advisable. General requirements as to characteristics affecting the service that the apparatus gives are enforced by most maritime countries. Many of the newer aids are still being developed and improved. The demand for efficient service, together with the interchange of information between countries, has kept the apparatus and the character of service sufficiently uniform.

International standards have been adopted for many of the communication aids and for messages concerning navigation. As already indicated, visual signals and codes were adopted by the International Marine Conference, held at Washington in 1889, and were further perfected by the International Radiotelegraph Convention in 1927. The former dealt also with the rules to prevent collisions, including lights to be carried by vessels under way and at anchor, fog signals, sound signals for vessels in sight of one another, and distress signals. The International Convention on Safety of Life at Sea, London, 1929, recommended some additions that have not yet come into effect.

Great progress has been made in adopting international standards for radio messages. At first, when but few vessels had radio instal-

lations and when there were but a few shore stations, no regulation was needed. As illustrations multiplied, various operators, finding some regulations and standards necessary, devised and adopted them voluntarily. International wireless telegraphic conferences were held in Berlin in 1903 and in 1906. The third conference, the International Radiotelegraphic Conference, held in London in 1912, and the Safety of Life at Sea International Conference, held in London 1913–14, adopted many standards that did come into effect internationally, or are embodied in national legislation. Some others were adopted without legislation. These standards were further considered by the International Radiotelegraphic Conference, held in Washington in 1927, and the second Safety of Life at Sea Conference, London, 1929. This has resulted in standards for time signals, danger signals, including reports of ice, derelicts, and tropical storms, also standards for meteorological messages, including the collection and dissemination of weather information and storm warnings, and for the safety signal and the alarm distress and urgency signal. The Washington convention also deals with radio-compass stations and with radiobeacon service.

The many conditions under which ships must be navigated in various seas and seasons, and especially in a fog or with low visibility, introduce an element of uncertainty in all methods known and used for position-finding at sea. Some methods are better under one set of conditions, and others are better under different conditions. Safety requires that the position, by whatever method obtained, be checked preferably by another method. Experience in the use and comparison of results with the different systems alone can tell which combinations are the better. Hence, the present necessity to take advantage of and to gain experience with every system that is an aid to navigation.

Evidently the codes and rules, the standards for messages, calls, reports and warnings, also the uniform time for their transmission, have been the means that have made such international communication practicable.

STANDARDIZATION OF SERVICE AREAS OF RADIO BROADCASTING STATIONS

By C. M. Jansky, Jr., *Washington, D. C.*

In no field of radio communication is there greater need for the adoption of uniform standards of service and uniform methods of measurement than in the definition and determination of the coverage obtained by radio broadcasting stations. The inherent complexity of the phenomena of radio transmission and the wide differences of opinion which exist among radio listeners with respect to what constitutes service are largely responsible for the difficulties which to date have stood in the way of standardization in this field.

A complete radio-communication system may be considered as composed of three parts—(1) The transmitting station proper, (2) the transmission medium, and (3) the receiving installation. Knowledge concerning the design of radio transmitting and receiving apparatus has progressed immeasurably beyond the knowledge of the transmission medium or the ability to control it. Consequently,

consideration of the problems of standardization are immeasurably simplified if attention is confined to conditions as they exist at the receiving location without attempting to express any relationship between conditions at the transmitter and conditions which may be expected at the receiving location. In fact, the vagaries of radio transmission are such that generalized attempts to express coverage and service areas in terms of power and frequency are bound to result in specific cases deviating to such an extent from each other as to render the result highly inaccurate.

The operation of a radio broadcasting transmitter produces at any receiving location a radio-frequency field the intensity of which may be measured. There are present at any particular receiving location, in addition to the field from the desired broadcasting station, other electrical fields capable of producing noises and disturbances in the receiver. Some of these may be referred to as atmospherics (static). Others produced by man-operated electrical machinery are sometimes referred to as inductive interference. There may also be produced at the receiving location electric intensities from radio stations other than the one the listener desires to hear. The presence of these may be referred to as radio interference. (Some years ago some interference due to the operation of regenerative receiving sets was of importance, but this factor may be neglected now.)

It is not absolute value of electric intensity from the desired broadcasting station which is of importance, but the ratio of this intensity to the other disturbances present at the receiving location. This is due to the fact that the sensitivity of modern receiving sets has been carried to a point where weakness of signal is not in itself an important factor in limiting its usefulness.

If attention is confined to the area immediately surrounding a broadcasting station, there will, in general, be a decrease in the intensity at the receiving location as the receiving location is moved in a line directly away from the transmitter location. (This does not mean that the rate of falling off will be the same in all directions.) Out to a certain point this falling off of intensity has no effect upon reception except to require different adjustments of the volume control on the receiving set. However, a point will finally be reached at which reception from the desired station is marred by the presence of interfering disturbances from static, inductive interference, or radio interference.

If nighttime conditions are under consideration a fourth factor, fading, may serve to mar reception. As the receiving location is moved to points where the electric intensity from the desired station becomes lower and lower reception conditions become worse and worse until finally there is no possibility of enjoyment of the program.

There have been numerous grades of broadcast service defined and numerous standards set up for these grades. Also, different engineers have applied different names to these grades. However, there is now a distinct tendency to limit the grades of service to two and to define these as " primary " and " secondary." Since nighttime conditions are sometimes radically different from those in the daytime, it is also becoming common practice to differentiate between

night and day conditions. Thus it is common to speak of the "primary nighttime coverage area" and the "primary daytime coverage area" of a station.

Variations in interference conditions and the standards of service imposed by listeners preclude absolutely accurate word definitions of even primary and secondary coverage. However, the following description will serve to show the basis for determining the division line between the two.

The primary coverage area of a station is that area throughout which the station can be received without objectionable interference from static, electrical interfering noises, or interference from other radio broadcasting stations, practically all of the time the station is in operation. Primary daytime coverage refers to daytime conditions, while primary nighttime coverage refers to nighttime conditions.

In an area where several stations deliver primary-grade service there will be no tendency for the listener to select the station giving the strongest signal since, for all practical purposes, all signals will be equally satisfactory providing they exceed the minimum value necessary for primary-grade service. Rather, if several primary-grade services are available, the listener's choice will be based entirely on program appeal. The standards for primay coverage are necessarily high and should be considered as such.

Secondary coverage is that coverage obtained by a station which does not meet the high standards set forth for primary coverage. In secondary coverage areas there may be times when static, interference, or fading prevent the fullest enjoyment of programs.

In conclusion, further progress in the standardization of broadcasting station service areas will rest upon recognition of the following fundamental considerations: (1) Coverage must be determined by a consideration of conditions at receiving locations throughout the area served. (2) Coverage can only be determined by an engineering study of field intensities and conditions at the receiving location. It can not be based upon listener opinion if the results are to possess sufficient accuracy to be of value for comparative purposes. (3) Throughout the highest-grade coverage area (primary) value of service will, in general, be independent of the field strength produced by the station. (4) The differences between night and day time conditions are usually so great that both primary and secondary coverage should be subdivided to show separately night and day conditions. (5) Secondary night time coverage can not be shown on an area basis, and any attempts to show even secondary day coverage on an area basis must be made with extreme caution.

STANDARDIZATION OF AIDS TO NAVIGATION MAINTAINED BY THE BUREAU OF LIGHTHOUSES

The principal work of standardization encountered in the Lighthouse Service is the maintenance of a uniform system of buoyage upon all the coasts of the United States. Entering port, the navigator knows that the black buoys with odd numbers should be kept on his left hand and the red buoys with even numbers on his right, and that all ports and channels under United States jurisdiction

are marked in the same manner. This standard for the coloring of buoys, to indicate the right and left hand sides of channels, established by act of Congress in 1850, has proved of great value to shipping. Additions to the buoyage system as they become necessary are made to conform to the same system. With the introduction of lighted buoys there arose the question of the color of the lights. The lighting of buoys is not so fully standardized; but red lights are used only on the right sides of channels, entering, and green lights only on the left sides, with white lights on either side.

In the rapid development of the radiobeacon which has taken place during the past 10 years, considerable standardization has been attained. Originally developed as an aid to navigation during periods of fog, and, therefore, to be operated only at irregular intervals, the radiobeacon soon proved to be of value in clear weather as well; and they are now generally operated on an hourly schedule in clear weather, as well as during fog.

Particular care has also been taken to devise a system of radiobeacon signals which would distinguish each radiobeacon from others near by and still preserve a uniformity throughout the system which would differentiate this type of signal from all other radio transmissions. This has been accomplished by using a single Morse character for each station and repeating this signal so long as the station is broadcasting. Hearing the repetition of a Morse code letter, the navigator knows that he is listening to a United States radiobeacon, and by identifying the particular signal he is informed of the exact station which is sending. This simplification of signals and hourly operation has aided in creating confidence in the radiobeacon system as a whole.

While the primary need of most aids to navigation is a means of distinguishing one signal from another, much standardization of equipment has still been possible. Standard types of buoys have been developed—illuminating apparatus is now purchased or manufactured in a comparatively small number of types and sizes. Lanterns and lenses, particularly the smaller sizes, have been well standardized at a considerable reduction in cost and many other items entering into the maintenance of lights and buoys so designed that they are applicable to conditions in all parts of the country.

As the United States Lighthouse Service has operating bases scattered along the entire coast line of the country and upon the Great Lakes, there is of necessity much purchasing of supplies and materials locally; but the tendency has been toward the preparation of standard specifications and for the purchasing, whenever practicable, to be done through a central depot. The service also maintains a few shops for the manufacture of certain special items.

Standardization has simplified the work of ordering items so manufactured and eliminated the need for special drawings and specifications. It has also effected great savings in both time and expense in the many emergency replacements which must be made because of storm and similar damage.

The bureau is represented on several committees of the Federal Specifications Board, and a representative of the bureau is serving on the executive committee of the board as a Commerce Department representative.

II. INTERNATIONAL STANDARDIZING AGENCIES

INTERNATIONAL CONFERENCE ON WEIGHTS AND MEASURES

The fundamental international standardization bodies comprise the purely governmental agencies, such as the International Conference on Weights and Measures, the International Committee on Weights and Measures, and the International Bureau of Weights and Measures. All of these were established by the Metric Convention signed in Paris, May 20, 1875, to which 32 nations of the world are now parties, as follows:

Argentina.	Germany.	Portgual.
Austria.	Great Britain.	Rumania.
Belgium.	Hungary.	Serbia.
Brazil.	Ireland.	Siam.
Bulgaria.	Italy.	Spain.
Canada.	Japan.	Sweden.
Chile.	Mexico.	Switzerland.
Czechoslovakia.	Netherlands.	Union of Socialist Soviet Republics.
Denmark.	Norway.	
Finland.	Peru.	United States of America.
France.	Poland.	Uruguay.

At the beginning of the year the adherence of Netherlands to the Convention of the Meter was registered.

The conference is held at least once in six years, and the signatory countries send official delegates. The next meeting is planned for 1933 at the bureau headquarters. The conference decides all questions of fundamental policy affecting the units and standards of the metric system and the procedure by which they are maintained. The committee administers the active affairs of the International Bureau of Weights and Measures, located on neutral territory in the Parc du St. Cloud, near Paris, France.

INTERNATIONAL COMMITTEE ON WEIGHTS AND MEASURES

At the meeting of the committee held beginning April 10, 1931, D. Isaachsen, secretary of the committee, read a report on some of the activities of the bureau. (See International Bureau of Weights and Measures, p. 64.)

The conclusions of the Advisory Committee on Electricity of June, 1930 (see Standards Yearbook, 1931, p. 35), relating to standards of light and electrical units and standards were examined, and the decisions involved were considered.

The equipment of some of the national bureaus required determinations of standards of length and mass, among them standards of platinum-iridium for the Institute of Weights and Measures at Prague; others of gold, crystal quartz, or nickel-chromium (baros).

Volume XVIII of the Travaux et Memoires was distributed in January, 1930. It contains the following memoirs:

Nouvelles études Thermometriques, par. Ch.-Éd. Guillaume.
La temperature d'ébullition de l'eau, par Ch. Volet.
Applications pratiques des interferences lumineuses à l'études des calibres industriels et autres longueurs à bouts, par. A. Perard.

By virtue of the authority which the Seventh General Conference has accorded, the international committee set the figure of the budget at 150,000 gold francs, divided among the nations adhering to the Convention of the Meter during the year 1931.

The Conservatoire des Arts et Metiers no longer possesses any standard kilogram which may be disposed of, so that on request from Czechoslovakia a national prototype kilogram will be constructed by Comptoir Lyon-Allemand in Paris. This standard will bear the number "41."

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES

(Paris, France)

(From a Memorandum Received from the Director)

The new quarters for the section of electricity are nearing completion. Arrangements are now being made for heating the old building, together with the new one. Until now the laboratory rooms of the international bureau have been heated in too uncertain a manner; beginning this winter they will be heated in a rational manner. The instruments for the new laboratories have been ordered and several sent for test at the Laboratoire Central d'Electricité, whence they will go to the international bureau as soon as the rooms are arranged.

In the past few months the bureau has again devoted considerable time and effort to the determination of the expansion of the platinum-iridium meter prototypes; the work may now be considered completed.

To measure lengths in determininations of coefficient of thermal expansion, two procedures have been employed in succession. The one consists in expressing the differences of length in terms of the pitch of the micrometer screw; the other introduces the divisions of a scale, which carries at each extremity a centimeter divided into 64 parts. The interval between two successive lines corresponds, within about a micron, to the lengthening of the platinum-iridium meters, with a change of temperature of 18° C. Reference is then made, in the successive measurements, to different lines of the scale, not introducing the micrometer except for the small differences which are of the order of a micron. The auxiliary scale itself was studied independently; the centimeter was compared with many centimeter standards, and the position was determined for each line by two successive calibrations, first of the eighths of a centimeter and then of the eighths of these intervals. The results obtained by the new procedure are practically identical with those which were obtained by the micrometer.

The conclusions drawn from these activities are: The expansion of the Johnson-Matthey melt from which the international meter was made is given by the formula

$$\alpha = (8.6210 + 0.001\ 80\ \theta)\theta \times 10^{-6}$$

The expansion of the melt from which were drawn the standard bars T_2 and T_3 is expressed, respectively, by:

$$\alpha = (8.6220 + 0.001\ 80\ \theta)\theta \times 10^{-6}$$

and

$$\alpha = (8.6131 + 0.001\ 80\ \theta)\theta \times 10^{-6}$$

Finally, the great melt of the Conservatoire National des Arts et Metiers, called the alloy of 1874, is given by:

$$\alpha = (8.6014 + 0.001\ 80\ \theta)\theta \times 10^{-6}$$

To determine the form of the equation, use was also made of numerous measurements made by means of the Fizeau apparatus, which, in an interval of 100° C., gives, other things being equal, the second coefficient with an accuracy proportional to the square of the temperature interval; that is to say, to $(100/36)^2 = 7.7$.

Advantage was taken of the fact that the expansion of the platinum bars is now well known in order to compare by the relative method the principal standards of the bureau, some of which are of invar, others of nickel steel (42 per cent). At the same time a recalculation was made of the lengths of the different bars which have been sent to the bureau for the first of the periodic comparisons. For the comparison with the bars of the bureau, the results are immediately given at 0° when the expansions are equal; there is a small correction when the comparisons have been made with T_3, the laboratory standards used by the international bureau. Prototype meters from Belgium, Finland, and the United States are now at the bureau and will be compared as soon as it can be done; that is to say, when the workmen engaged in installing the heating system leave the laboratories. Then all of the primary series of national prototype meters will have been returned to the bureau, with the exception of those of Bavaria, of Portugal, and of Union of Socialist Soviet Republics, which have not been compared since 1889.

With reference to quartz standards of length, the quartz block which Dr. Samuel W. Stratton presented to the international bureau is now being worked on. It has been possible to find in this block three decimeters which have no flaw. These will be promptly completed by the constructor and then tested and calibrated. We are waiting for standards of fused quartz which we hope to receive from the Bureau of Standards.

The standards of the 24 m base, concerning which there was a question in my last correspondence, have been studied and rolled upon a drum, then carried to Teddington, where they are at the present time. It is expected that the present tests will give a comparison of the two bases without the possibility of there being a doubt as to the results.

Two memoirs have already been printed: Ch.-Éd. Guillaume, La dilatabilité des Mètres prototypes en platineiridié, et A. Pérard, Note sur la détermination d'étalons millimétriques et centimétriques en longueurs d'onde lumineuses.

The second memoir treats of a question which was raised by M. Benoit, but which he left with a publication all too short in the Journal de Physique. His manuscript has been returned to the bureau, and full details have now been published. The method which he employed for determining the corrections to the lengths of the intervals of the scales is based on the measurements which M. Michelson executed in 1892 at the bureau; the scales studied by M. Benoit give, for the first time, the true value of millimeters without the necessity of the usual extended series of micrometer microscope measurements. These bars have been very useful, for example, in determining the value of one turn of the drum of micrometer microscopes.

As to the standard temperature for end standards of length, the international bureau has assembled all the recommendations on this subject. These agree that industrial standards should be defined at 20° C. as proposed by the Bureau of Standards. The last Procès-Verbaux of the meetings of the international committee contains the acceptance by Great Britain of this definition of industrial standards of length.

INTERNATIONAL ASTRONOMICAL UNION

The draft of the proposed new statutes and details of amendments from adhering organizations have been circulated to all adhering organizations. The dates for the next ordinary meeting of the General Assembly at Cambridge, Mass., have been provisionally fixed for the week of September 2 to 9, 1932.

PROPOSED INTERNATIONAL CALENDAR—PROGRESS IN SIMPLIFICATION

Furnished by Dr. C. F. Marvin, Vice Chairman, National Committee on Calendar Simplification for the United States

Readers who seek information not found in this progress statement are referred to other articles in the Standards Yearbooks for 1929, 1930, and 1931, especially the latter, which gives a brief outline of the movement up to near the close of 1931. Some informative matter, if not out of print, may be obtained from George Eastman, chairman, National Committee on Calendar Simplification for the United States, Rochester, N. Y.

It will be remembered that so-called national committees have been formed, upon the request of the League of Nations, in nearly all of the principal nations.

A few extreme religious leaders, when speaking recently before the League of Nations in vigorous opposition to the use of supplementary days bearing nonweek-day names, leveled severe criticism against the United States national committee on the ground that it calls itself the national committee, when it is only an organization of citizens of the United States, with a few Government officials having no authority to speak for the Nation or the Government.

Such criticisms are most unfair and unjust, because all the reports of the committee specifically state just how the committee was organized at the league's request, and no claim is made anywhere that it speaks, or is empowered to speak, for the Federal Govern-

ment. The league's correspondence with the United States on this question has been fully published, and no Federal objection was found to the organization of the committee as a private initiative or to the acceptance of membership thereon by Government officials as private persons. No representations or implications have been made by the committee that its work has been officially indorsed by the Government. It is, however, the only "national committee" for the United States, and its reports have been received by the Department of State and transmitted to the League of Nations.

Without exception, it is believed, the national committees of all the other nations are similarly organized and empowered. The uniform name "national committees" is a natural outcome of the request from the league that such committees be formed by the various administrations. Furthermore, the whole purpose of these committees has been to examine into the faults and defects of the present calendar; to study the possible or practicable plans for simplification; to inform a representative portion of the public as fully and impartially as possible concerning the pros and cons of proposed changes; to ascertain as fairly and fully as possible the general opinions prevalent; and, finally, to submit this information to the State Department. Only by these means has it been possible for the United States (and other nations) to comply with the request of the secretary general of the League of Nations

> to forward to him any useful information on this subject which it (the United States) may possess.

This clarifying statement will enable readers to fully understand the organization, status, and authority of the national committee for the United States.

A number of significant incidents have marked progress of the calendar movement for the year 1931. A recent report by the League of Nations lists national committees for the following nations:

Argentina.	Finland.	Peru.
Belgium.	France.	Poland.
Bolivia.	Germany.	Portugal.
Brazil.	Great Britain.	Salvador.
Chile.	Guatemala.	Spain.
Costa Rica.	Italy.	Sweden.
Cuba.	Latvia.	Switzerland.
Czechoslovakia.	Netherlands.	United States.
Ecuador.	Nicaragua.	Yugoslavia.
Estonia.	Panama.	

With very few, perhaps no, exceptions the question of simplification of the calendar is more generally and better understood within the United States than in any other nation. The national committee for Great Britain was formed very late in 1931, and little or no organized effort was made by it to awaken a fully informed public interest therein or ascertain the trend of thought thereon. Germany had a strong committee, and the information seems to favor the 13-month fixed calendar. Italy seems to be opposed to any change. The opinion is very nearly unanimous that a general public demand exists for the fixing or stabilization of Easter. In Great Britain the celebration of Easter on as nearly a fixed date as

possible, about the second Sunday in April, is a change favored by all; and Parliament has already enacted the necessary law, operative when Christian churches elsewhere are ready to make such a change.

Even the most enthusiastic advocate of simplification must recognize that general world opinion or interest reaching down into the whole population is very little aroused. To a certain extent it may be fairly said that more or less apathy among a vast body of the human population may not unfairly be construed as a general absence of aggressive opposition. If we contemplate that in past ages the great changes of calendars were always made by some great world authority, an imperial edict, or a pontificial decree, we note the contrast that for the movement to-day there is a total absence of any competent and adequate world authority, and if the real benefits of simplification are to be secured it is necessary to awaken a wide demand for changes from a representative body of intelligent and fully informed humanity. This is obviously a difficult and time-consuming process. It is believed, however, progress has been marked and significant since the question was taken up by the League of Nations in 1923.

Opposition.—It is important that a proper appraisal be made of opposition. Probably all changes of the calendar in the past, especially the introduction of the Gregorian calendar, aroused deep-seated and violent opposition, which persisted for centuries. Nevertheless, it is difficult to find any one to-day who does not recognize that every change of the calendar made in the past set up a new structure that was definitely better than the old, even though the new form was itself still defective. It is impossible to hope to change and make better the present calendar without more or less strong opposition; but it is certain that if changed wisely, not sentimentally, posterity will benefit by and approve those changes which a few may now vigorously oppose.

Supplementary Report.—In anticipation of the conferences on matters of the calendar scheduled to occur in 1931, the national committee for the United States collected additional information not included in its original report of August 14, 1929, and submitted the same as a supplementary report to the Department of State, indicating in its letter of transmittal as of May 9, 1931, the belief that the department was justified in transmitting the report in further compliance with the request from the secretary general of the League of Nations for information from the United States on the question of the simplification of the calendar.

The topics discussed in this report are:

I. Growth of general interest.
II. Use of 13-period calendars.
III. Religious opinion.
IV. Leap year rule and date of the equinox.

Lack of space here prevents mention of much important information contained in this report.

Preparatory Committee and Fourth General Conference.—The agency of the League of Nations which has handled the question of the calendar is known as the Advisory and Technical Committee on Commur ications and Transit, briefly "the transit committee." At

the request of this committee the Council of the League of Nations placed the following item upon the agenda of the Fourth General Conference:

Examination of the expediency from an economic and social standpoint (*a*) of fixing the movable feasts and (*b*) of simplifying the Gregorian calendar.

To assist the general conference in its work, the transit committee extended invitations to officials representing national committees or individuals interested in calendar reform in some 15 different nations to attend a preparatory conference. This conference sat at Geneva from June 8 to June 13, 1931, under the chairmanship of M. Djouritchitch, former director general of the Yugoslav State railways and a member of the transit committee. The writer was a member of this preparatory committee, representing the national committee for the United States.

The full report has been issued by the League of Nations as a document entitled "Fourth General Conference on Communications and Transit, Preparatory Documents, volume 1, Calendar Reform. No. 4, C. G. C. T. 1, Geneva, June 17, 1931."

The report contains a concise view of the work of national committees which have reported thus far, and, recognizing that even yet public opinion is still very far from being fully informed, a resolution was passed expressing the hope that the respective national committees would take steps as soon as possible for the better enlightenment of public opinion to the questions relating to the reform of the calendar, which the general conference would have to consider in October.

The chief objective of this preparatory conference was to collect and pass on to the general conference, without expression of any definitive views on its own part, the whole state of the question (*a*) of fixing the movable feasts and (*b*) simplifying the Gregorian calendar as brought out by the reports from the nations represented unofficially by the members present.

In the fourth section of the report a procedure for the Fourth General Conference is briefly suggested. The essence of these proposals can not be more succinctly stated than by quoting from the report, as follows:

> The preparatory committee would suggest to the conference sitting in committee that the question of the economic and social aspects of the stabilization of Easter and the question of the economic and social aspects of the general reform of the calendar should be examined separatively and consecutively. As regards the general reform of the calendar, it might perhaps be advisable to discuss the following points separately and in turn: (1) The drawbacks of the present calendar; (2) the principle of the establishment of a perpetual calendar and the respective merits of the perpetual calendar and of the calendar simply involving the equalization of the quarters, without the introduction of "supplementary" days; and (3) the respective advantages and inconveniences of the two definite plans for a perpetual calendar; that is, a year of 13 months and a year of 12 months.
>
> In the preparatory committee's opinion it would also be advantageous for the conference, during its discussions, to distinguish between two groups of questions, namely, those relating to the desirability of the reform of the calendar, either in general or according to some particular plan, and those questions concerning the possibility of the immediate introduction of the reform.

The date finally set for the Fourth General Conference is October 12, at Geneva, and the President has deemed it advisable to accept

the invitation of the League of Nations to send a representative, and the writer has been designated to attend the conference for the purpose of participating in the consideration of matters relating to the calendar. He will collaborate with the Hon. M. Prentiss B. Gilbert, United States consul at Geneva, who will follow the interest of the United States concerning other matters on the agenda of the conference.

INTERNATIONAL UNION OF GEODESY AND GEOPHYSICS

Furnished by J. A. Fleming, General Secretary of the American Geophysical Union, 5241 Broad Branch Road Northwest, Washington, D. C.

General.—Previous reports of various activities pertaining to standards, standard instruments, and nomenclature by the International Union of Geodesy and Geophysics in geodetic and geophysical fields are given on pages 20 to 24, 36 to 40, 22 to 25, and 54 to 60 of the Standards Yearbook for 1928, 1929, 1930, and 1931, respectively.

Publications relating to the transactions, including scientific papers and reports, for the various assemblies of the Union and its associations may be procured through the general secretary of the union (Brigadier H. St. J. L. Winterbotham, Ordnance Survey, Southampton, England) or through the secretaries of the seven associations among which the activities of the union are divided. These are: Geodesy, Général G. Perrier, 78 rue d'Anjou, Paris (8e), France; seismology, Prof. E. Rothé, 38 boulevard d'Anvers, Strasbourg (Bas-Rhin), France; meteorology, Capt. Ph. Wehrlé, 176 rue de l'Université, Paris (7e), France; terrestrial magnetism and electricity, Dr. Ch. Maurain, 191 rue Saint-Jacques, Paris (5e), France; oceanography, Prof. Rolf Witting, Konstantinsgatan 8, Helsingfors, Finland; volcanology, Prof. A. Malladra, R. Osservatorio Vesuviano, Resina (Napoli), Italy; and hydrology, M. Diénert, 6 rue de la Seine, Paris (6), France.

The fifth general assembly of the international union is planned for Lisbon, Portugal, about October, 1933.

Publications.—Publications covering the transactions at the Stockholm meeting of August, 1930, issued since the account given in the Standards Yearbook for 1931 are noted below.

Union Géodésique et Géophysique Internationale, Quatrième Assemblée Générale, réunie a Stockholm, 15–23 Août, 1930. Toulouse, Imprimerie et Librairie Édouard Privat, 1931 (99), cm P. This volume, besides giving in detail the actions taken at the Stockholm assembly, lists also the names of the countries affiliated with the International Union of Geodesy and Geophysics, together with lists of the adhering organizations, the delegates and guests at the international assembly, and the officers of the international union and its associations, followed by a list of the officers of the national committees.

Section de Séismologie, Comptes Rendus des séances de la Quatrième Conférence, réunie a Stockholm du 14 au 23 Août, 1930, Union Géodésique et Géophysique Internationale. Rédigés par le Secrétaire E. Rothe. Toulouse, Imprimerie et Librarie Édouard

Privat, 1931 (329 with pls.), 26 cm P. Following the lists of officers, these transactions of the Association of Seismology give the detailed progress reports, committee reports, and scientific papers presented, and the actions taken at the joint meetings held with the associations of Geodesy and of Terrestrial Magnetism and Electricity and with the Association of Volcanology.[1]

Section de Magnétisme et Electricité Terrestre, Comptes Rendus de l'Assemblée de Stockholm, 15–23 Aôut, 1930, Union Géodésique et Géophysique Internationale (Bulletin No. 8), publiés par les soins de Ch. Maurain, Secrétaire de la Section et Directeur du Bureau Central. Paris, Les Presses Universitaires de France, 1931 (479 with pls.), 26 cm P. This volume of 479 pages includes in complete detail the transactions of the meetings held at Stockholm, progress reports, committee reports, and scientific papers presented, many of which, as indicated in the Standards Yearbook for 1931, involved important actions relating to international standards. Matters not referred to in the last yearbook which are of interest in this connection and which are published in the volume include the report of the special committee on standard terminology and symbols.

Two bulletins relating to the Stockholm meetings of the associations of Oceanography and of Scientific Hydrology were also published as follows:

Section d'Oceanographie, Réunion plénière de la Section (Stockholm, Aôut, 1930), Union Géodésique et Géophysique Internationale, Bulletin No. 14. Venezia, Carlo Ferrari, 1930 (50), 28 cm P.

Section d'Hydrologie Scientifique, Réunion plénière de la Section (Stockholm, Aôut, 1930), Union Géodésique et Géophysique Internationale, Bulletin No. 18. Venezia, Carlo Ferrari, 1930 (32), 30 cm P.

These give the minutes of the Stockholm meetings of the two associations, together with the reports of the various committees, reference to which were made in the Standards Yearbook for 1931.

Section de Géodesie, Travaux de la Section de Géodésie de l'Union Géodésique et Géophysique Internationale. Tome 7, rapports nationaux sur les travaux exécutes dans les différent pays établis a l'occasion de la Quatrième Assemblée Générale, Stockholm, 11–23 Aôut, 1930. Paris, Au Secrétariat de la Section, 1930 (contains individual reports of adhering countries), 29 cm P. In this volume are bound the reprints of the national progress reports of the different countries submitted at the Stockholm meetings of the association. Thus far the volume giving the complete transactions of the Stockholm meetings of the Association of Geodesy has not been published. This statement applies also as regards the transactions for the meetings of the associations of meteorology and volcanology.

AMERICAN GEOPHYSICAL UNION

Furnished by J. A. Fleming, General Secretary of the American Geophysical Union, 5241 Broad Branch Road Northwest, Washington, D. C.

The twelfth annual meeting of the American Section of the International Union of Geodesy and Geophysics, namely, the American Geophysical Union, was held in Washington, April 30 and May

[1] All of these matters were briefly abstracted in the report printed in the 1931 Standards Yearbook.

1, 1931. The transactions of the general meeting of the union and of the meetings of its seven sections were published in June, 1931, by the National Research Council in a volume of 229 pages under the title "Transactions of the American Geophysical Union, Twelfth Annual Meeting, April 30 and May 1, 1931, Washington, D. C." The following paragraphs abstract briefly those activities at the twelfth annual meeting of the union pertaining to standards and standard instruments.

General Meeting of the Union.—Among the five resolutions unanimously approved there were three bearing on gravity at sea, international cooperation in the study of tidal waves, and comparisons of new types of seismological instruments, which are of interest from the viewpoint of standards. These three resolutions are as follows:

1. Resolution on gravity at sea proposed by the sections of geodesy and volcanology

Whereas the United States Navy Department, in cooperation with the Carnegie Institution of Washington, conducted a gravity campaign in 1928, during which observations were made under the direction of Dr. F. A. Vening-Meinesz, member of the Dutch Geodetic Commission, at many points in the Caribbean Sea, the Gulf of Mexico, and the Atlantic Ocean to the northward of Porto Rico, thus adding materially to the knowledge of the crust of the earth in the regions covered, and furnishing data for the figure of the earth; and

Whereas much additional information about gravity at sea should be made: Therefore be it

Resolved, That the American Geophysical Union of the National Research Council recommends to the Navy Department that it give thought to the question of continuing its work on gravity at sea and of securing the necessary soundings to supplement such work, especially in the waters of the West Indies including the Caribbean Sea: And be it further

Resolved, That a copy of this resolution be forwarded to the Secretary of the United States Navy.

2. Resolution on international cooperation in the study of tidal waves proposed by the sections of seismology and oceanography

Whereas a communication has been received through the Department of State and the National Research Council from M. Hubert, secretary of the Commission of the International Union of Geodesy and Geophysics for the Study of Tidal Waves, suggesting and inviting participation of the United States in studying tidal waves and various phenomena associated with them: Therefore be it

Resolved, That the American Geophysical Union indorses the plan of the commission and recommends the participation by organizations and individuals of the United States who may be concerned, and in order that a suitable plan for such participation may be developed, the chairman of the sections of seismology and oceanography are authorized to appoint two members from each section as a joint committee: And be it further

Resolved, That a copy of this resolution be sent to the secretary of the Commission of the International Union of Geodesy and Geophysics for the Study of Tidal Waves.

3. Resolution on comparisons of new types of seismological instruments developed in the United States with various types developed in Europe proposed by the section of seismology

Whereas the director of the Central Seismological Bureau of Strasbourg, France, has indicated the great desirability of direct comparisons of new types of seismological instruments developed in the United States with various types developed in Europe, and has offered the facilities of the central bureau for this purpose, preferably with the cooperation of an American seismologist: Therefore be it

Resolved, That the American Geophysical Union indorses this plan: And be it further

Resolved, That a copy of this resolution be sent to the Director of the Central Seismological Bureau of Strasbourg.

The committee appointed to undertake the realization of the resolution on international cooperation in the study of tidal waves consists of H. F. Reid (chairman), Perry Byerly, N. H. Heck, and H. A. Marmer.

The general scientific session of the union was devoted to a symposium on time signals sponsored by the sections of geodesy and seismology. The papers presented emphasized the great need of improved time service and the requirements of such service in electrical and physical measurements, in geodetic work, in seismological work, and in the establishment of world time, with several communications bearing on the standard-frequency transmitters and the accuracy of the primary frequency standards of the Bureau of Standards. Two informal communications made particular reference to the time service requirements of the National Broadcasting Co. and of the American Telephone & Telegraph Co., and Bell Telephone Laboratories.

At the meetings of the seven sections of the union which preceded the general meeting there were many communications presented relating to standards and determinations of standards.

Section of Geodesy.—Seven papers presented were devoted largely to progress reports on absolute determination of gravity, Mexican gravity stations, gravity work presented at the Stockholm meeting of the international union, on graduation and calibration of precision circles, on the astronomical establishment of points on an unsurveyed boundary in Canada, and on geodetic work during the past year in the United States.

Section of Seismology.—Following the consideration of proposals for the international intercomparison of recently developed types of instruments and study of seismic sea waves, papers and informal communications were presented, including a paper on the origin of earthquake waves, progress reports on the development of instruments, the use of precise triangulation and levels in California in seismological investigations, the registration of time signals, and velocity of explosion generated longitudinal waves in nepheline syenite. The secretary reported that following the resolution adopted at the eleventh annual meeting a grant had been provided by the Carnegie Institution of Washington, through its Advisory Committee in Seismology, to establish a seismological observatory at the Huancayo Magnetic Observatory in Peru.

Section of Meteorology.—Following five papers concerned chiefly with the International Polar Year proposed for 1932–33, the remainder of the program was devoted to considerations of the proposed International Cloud Atlas, atmospheric turbidity, measurements of color of the sea and the sky, and cyclical variations in precipitation, run-off, and lake levels, and their relation to long range forecasting.

Section of Terrestrial Magnetism and Electricity.—The following papers were published: Progress reports on the year's investigations and projects in the United States, a report on the proceedings of the International Section of Terrestrial Magnetism and Electricity at the Stockholm assembly, four papers bearing on extraterrestrial considerations in the fields of the section, and four papers bearing on polar research. A significant feature of the first group was the

cooperation of a large number of governmental, college, and commercial organizations in the United States and Canada which submitted 21 progress reports. The desirability of further magnetic and electric work in the polar regions of the earth, and especially during the proposed International Polar Year of 1932–33, was indicated in the papers of the last group.

Section of Oceanography.—This session was devoted almost wholly to progress reports of nine governmental bureaus and private research organizations engaged in oceanograpic work, showing the widespread interest and rapidly increasing development. Besides these reports there were two papers telling of progress in Gulf Stream temperature investigations and of the results obtained by duplicate measures of specific gravity of sea water by the Knudsen and Plummet methods.

Section of Volcanology.—Following a paper on the solubility of water in granite magmas, reports were presented to the section of volcanology on Merapi and its eruptions, volcanoes of Katmai district in 1930, the Tertiary volcano at Cripple Creek, Colo., and the Valles Mountain volcanic center of New Mexico.

Section of Hydrology.—This was the first annual meeting of the section of hydrology, organized in November, 1930. Following a brief account by the chairman on the organization, activities, and plans of the section, 12 papers were presented upon various scientific aspects of hydrology. Robert E. Horton's paper on "The Field, Scope, and Status of the Science of Hydrology" developed excellently the scientific possibilities of the section's field. Other papers of the program emphasized the absorption of precipitation and its penetration, glacier measurements, organization and work of various governmental hydraulic stations and laboratories, the need for closer cooperation among students of stream work, studies in evaporation, relation of ground-water hydrology and Pleistocene geology of the Platte River Valley and adjacent areas, significant studies in hydrology on the Pacific Coast, and reports on investigations in progress in hydrologic laboratories.

INTERNATIONAL GEODETIC ACTIVITIES

Furnished by the United States Coast and Geodetic Survey

In August and September, 1930, a meeting of the International Geodetic and Geophysical Union was held in Stockholm, Sweden. At this meeting of the union, the designation of each of its seven branches was changed from section to association. A fine spirit of cooperation was shown, as is indicated by the pledges of each of a number of groups of countries to carry on cooperative geodetic work that extends beyond the boundaries of a single country.

Opinions were expressed regarding the execution and completion of certain great arcs of first-order triangulation. One arc will extend across Europe and into Asia. Another arc will extend from the Arctic Ocean southward to the Mediterranean Sea, across that body of water and throughout the length of Africa. The completion of these two great arcs will make it possible to determine more accurately the figure of the earth, and also the deviation of the geoid or sea-level surface from the spheroid or mathematical surface.

The opinion was voiced at Stockholm that the adhering countries should carry on gravity-at-sea observations as soon and as rapidly as practicable. As is well known, Dr. F. A. Vening-Meinesz, of Holland, designed an apparatus with which he has successfully carried on gravity observations at sea on submarines. Such work has been done by the navies of Holland and the United States, and at present writing by a submarine of the Italian Navy.

There has been cooperation in geodetic work in North America. Engineers of the United States Coast and Geodetic Survey and of the Department of Geographical and Climatological Research of Mexico, worked together in making a connection in the vicinity of El Paso, Tex., and Juarez, Mexico, between the triangulation systems of the United States and Mexico. This work was successfully completed last winter.

The Director of the United States Coast and Geodetic Survey and the Director of the Geodetic Survey of Canada reached an agreement regarding the application of the results of the adjustment of the combined level nets of the two countries. By means of such an adjustment, the most probable values for the elevations of the leveling bench marks along the international boundary were obtained.

The Director of the Geodetic Survey of Canada did not feel justified at the present time in changing the elevations of his level net to conform to those resulting from the adjustment of the continental net. The Director of the United States Coast and Geodetic Survey proposed that the United States should adopt the elevations of the junction points of the network of lines in the United States, including the elevations resulting from the adjustment of the bench marks that lie along the international boundary, which was indorsed by the Director of the Geodetic Survey of Canada. While the present level nets of the two countries show slightly different elevations for the junction bench marks at the boundary, the exact difference between these two sets of elevations is known and can be applied by any one who is carrying on engineering or other operations on both sides of the boundary.

From this continental level net adjustment it was found that the mean sea-level surface along the Pacific Ocean is somewhat higher than that of the Atlantic Coast of North America. The average difference is approximately 2 feet. It was also found that mean sea level slopes upward to the north on both the Atlantic and Pacific Coasts. This upward slope is approximately 1 foot between Florida and the coast of the Gulf of St. Lawrence, on the Atlantic, and also about 1 foot between San Diego, Calif., and the coast of British Columbia, on the Pacific.

It is very desirable to have the national gravity base stations of the world all connected into a single system. The fundamental gravity base station is now Potsdam, Germany. A connection was made some 30 years ago between Washington, D. C., and Potsdam, and recently the Director of the Bureau of Standards requested the Director of the United States Coast and Geodetic Survey to make another connection between the two.

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A. H. Miller, of the Dominion Observatory, Ottawa, Canada, made a connection between Ottawa and Potsdam and certain other European gravity base stations. He also connected the gravity base stations of Ottawa and Washington. Doctor Meinesz, of Holland, in 1928, made a connection between the European gravity net and Washington. Both he and Miller found that their values for Washington were higher than the one now in use. It is thus seen that some doubt exists as to the exact value at Washington, and the proposed new connection will be of much value.

Gen. Georges Perrier, secretary of the International Geodetic Association, Paris, France, continues to edit and issue the Bulletin Géodésique, the official journal of the association. During the past two or three years he has been preparing a bibliography of the current geodetic literature of the world, which should prove of great interest and value.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Central Office of the International Electrotechnical Commission, 28 Victoria Street, Westminster, London, S. W. 1, England

Furnished by Clayton H. Sharp, president, United States national committee of the International Electrotechnical Commission

The International Electrotechnical Commission was organized in 1906, an outgrowth of a resolution adopted by the International Electrical Congress of St. Louis, in 1904, to the effect that steps should be taken to secure the cooperation of the technical societies of the world by the appointment of a representative commission to consider the question of standardization of nomenclature and rating of electrical apparatus and machinery.

The term of president of the International Electrotechnical Commission is concluded at each plenary meeting which normally will be held every four years. Dr. A. F. Enström was elected president at the meeting in the Scandinavian countries held in the summer of 1930. The next plenary meeting, which will be the eighth, will be held in Czechoslovakia in 1934.

The work of the commission is at present carried on by advisory committees on the following subjects: Nomenclature, rating of electrical machinery, symbols, hydraulic turbines, steam turbines, rating of rivers, internal-combustion engines, lamp caps and sockets, aluminum, voltages, electric traction equipment, insulating oils, rules and regulations for overhead lines, radiocommunication, electrical measuring instruments, shellac, terminal markings, and rating of switches and circuit breakers.

Of the subjects under consideration by the International Electrotechnical Commission five are in charge of the United States national committee, to which are intrusted the duties of the secretariat as follows: Nomenclature (which by a vote of the committee of action includes electric and magnetic magnitudes and units, and also letter symbols for scientific and engineering quantities), steam turbines, hydraulic turbines, internal-combustion engines, and rating of rivers.

The United States national committee approved on July 23, 1931, a consolidation with the Electrical Standards Committee. This committee will serve as a central agency in furthering the standardization work of the electrical industry in the United States under the procedure of the American Standards Association. The United

States national committee will be identical with the Electrical Standards Committee except for the addition of certain members especially identified with the work of the International Electrotechnical Commission. The established continuity of contact with the International Electrotechnical Commission will be preserved through the United States national committee.

The following is a brief summary of current standardization projects:

Nomenclature.—This subject is dealt with by advisory committee No. 1, which is subdivided into three sections as follows:

A. *International electrotechnical vocabulary.*—A comprehensive vocabulary of technical definitions in French and English is under preparation. Parts dealing with fundamental and general definitions, also telegraphy, telephony, and signaling, are practically completed. The former group contains, among others, definitions of fundamental importance, such as relate to the constitution and properties of matter, electricity and magnetism, electrochemistry, and units and systems of measurement.

B. Electrical and magnetic magnetitudes and units.—The following names for cgs units were adopted at the Oslo meeting in 1930: Magnetic flux, maxwell; flux density, gauss, magnetic field intensity, oersted; magnetomotive force, gilbert.

A meeting was held on September 17, 1931 in London and the above actions taken at the Oslo meeting were confirmed. Furthermore, action was initiated looking to cooperation with the International Union of Pure and Applied Physics on matters in which physics and electrotechnics meet.

C. *Letter symbols and signs for physical, mathematical, and engineering purposes.*—This section, which was instituted at the Oslo meeting, will carry on a revision of publication 27 as regards matters within its scope.

Electrical Machinery.—A revised edition of the Rules for Electrical Machinery, Publication 34, was agreed upon at the Oslo meeting (1930) and has been ratified by all the national committees. This edition supersedes the edition of 1920 and represents many years of arduous work in an attempt to bring about agreement. Important concessions, particularly with regard to temperature rise limits, were made by a number of the national committees, making the present publication possible.

The efforts of advisory committee No. 2 are now directed to unfinished work and new proposals which will lead to future revisions.

Symbols.—Additional symbols relating to telephones and telegraph, electric traction, relays, and other automatic devices, supplementing publication 35 are under preparation by advisory committee No. 3.

Steam Turbines.—Agreement was reached at the Oslo meeting to:

Publication No. 45, Steam Turbines, Part I, Specification.
Publication No. 46, Steam Turbines, Part II, Rules for Acceptance Tests.

The secretariat, which resides in the United States national committee is working on an appendix to Part II which will contain informative data relating to instruments and measurements.

Edison Screw Lamp Bases and Sockets.—Certain standards for Edison screw lamp bases and sockets based chiefly on European practice were adopted at the Scandinavian meeting in 1930. At a meeting of advisory committee No. 6 held in September, 1931, in Cambridge, England, the American standards for the Edison base and socket shells were also recommended as an International Electrotechnical Commission standard.

Aluminum.—Agreement to a standard of resistivity is prevented at the present time because of differences in the commercial products in America and Europe. Results of measurements of density, resistivity, and temperature coefficient on a considerable number of representative samples, both of hard drawn and annealed aluminum wire, have been prepared and submitted to the International Electrotechnical Commission through the United States national committee.

Standard Voltages and High Voltage Insulators.—It was decided at the Stockholm meeting to provisionally adopt 400 kv in addition to the standard voltages included in publication 38. As regards insulators, agreement has been reached relative to the duration and methods of applying the test voltage, the position of the insulator during tests, and the angle of incidence, intensity, and resistivity of the water spray. Other points remain to be settled.

Electric Traction Equipment.—A standard for traction motors is about to be completed and proposals for other apparatus used in traction systems, including mercury arc rectifiers, are under consideration. A meeting of advisory committee No. 9 covering this subject is to be held in Brussels on October 26 and 27, 1931, at which the work will be continued.

Insulating Oils.—Certain principles for making tests have been agreed upon which will be formulated into a code. Comparative tests will be carried out by the various national committees, mainly with the object of determining the accuracy with which results may be obtained by the various laboratories. Methods of sampling proposed by the United States national committee have been accepted.

It has been agreed that for international purposes viscosity will be expressed in kinematic centipoises. It is further proposed that official viscosity conversion tables and a standard reference temperature be established.

Rules and Regulations for Overhead Lines.—The work of advisory committee No. 11 has consisted largely in a study of existing national rules and the formulation of underlying principles for a program of work.

Radiocommunication.—Agreement has been reached on certain dimensions of tubes and bases and other requirements for bases. Other subjects being given consideration are standard directions of rotation for switches and other controls; safety regulations; nonradio electrical interference with radio reception; letter symbols for the amplification, slope, and internal resistance; and acceptance specifications for radio tubes, both receiving and power.

Measuring Instruments.—Standards for two classes each of a. c. watt-hour meters and instrument transformers were completed at the Stockholm meeting and are now in printed form.

Rating of Rivers.—Bases for computing and units for expressing water-power resources for statistical use and for the purpose of making comparisons between different rivers, river basins, regions, and countries have been approved.

Shellac.—The scope of advisory committee No. 15 has been enlarged to include lac and synthetic resins for insulating purposes. Various research proposals and tests, including tests to determine resin and ash content, are being considered.

Terminal Markings.—Agreement on a system of marking is held up on account of three radically different schemes in use in different countries. Enlargement of the scope of advisory committee No. 16 to include a definition of the direction of rotation, indications of transformer diagrams and colors for polarity of batteries and for conductors is contemplated.

Oil Switches and Circuit Breakers.—Definitions or rules for the following items have been agreed upon: Operating duty, standard series of interrupting operations, standard series of circuit making tests, recovery voltage, making and breaking current for determining the performance of circuit breakers, short-time current, power factor, breaking power, and breaking capacity.

Internal-Combustion Engines.—A draft of (1) specifications, and (2) rules for acceptance tests is being given active consideration by the advisory committee. The proposed scope includes the following types: (*a*) Gas engines, (*b*) carburetor-type engines, (*c*) Diesel-type engines, and (*d*) surface-ignition type engines.

New Undertakings.—A proposal to undertake the standardization of storage batteries is being considered.

International Electrotechnical Commission standards which are available in printed form are:

International Symbols: Part 1, Letter Symbols, Publication 27, December, 1920. Part 2, Graphical Symbols for Heavy Current Systems, Publication 35, 1930.

International Standard for Resistance of Copper, Publication 28, March, 1925.

Rules for Electrical Machinery, Publication 34, 1930.

Standard Dimensions of Bayonet Lamp Sockets and Caps, Publication 37, 1927.

Standard Voltages, Publication 38, 1927.

International Rules for Traction Motors, Publication 39, 1927.

Publication on the Testing of Hydraulic Turbines, Publication 41, 1928.

Recommendations for Alternating-Current Watt-Hour Meters, Publication 43, 1931.

Recommendations for Instrument Transformers, Publication 44, 1931.

INTERNATIONAL TECHNICAL CONSULTING COMMITTEE ON RADIO COMMUNICATION

This committee was organized by the International Radio Conference held in Washington in 1927. It was provided that the committee should be formed, for each meeting, of experts representing Governments and radio-operating companies. Its function is to advise the radio administrations of the world on technical radio questions which are submitted to it.

The committee held its second meeting at Copenhagen, Denmark, May 27 to June 8, 1931. The results of this meeting are embodied in 21 recommendations, the topics of which are—

Time limit for submitting questions for meetings of the Consulting Committee for International Radio.

Sending of proposals and new questions, by May 1, 1932.

Time limit and procedure for submitting proposals for meetings of the Consulting Committee for International Radio.

Publications of the opinions of the Consulting Committee for International Radio for the Madrid conference.

Organization of commercial radiotelephony between mobile stations and the land network.

Coordination of fixed station radiotelephony with wire telephony.

Extension of radiotelephone connection under unfavorable conditions.

Frequency list to be published by international bureau.
Precision of expression of frequency and wave length.
Separate call signal for each frequency in fixed service.
Definition of power of a transmitter.
Station frequency tolerances.
Methods of comparing national frequency standards.
Accuracy of station frequency meters.
Reduction of interference in the bands of frequencies shared by fixed and mobile service.
Constancy of station frequency.
Limitation of nonessential emissions.
Side-band suppression.
Limitation of harmonics.
Limitation of overmodulation.
Limitation of spacing waves in arc transmitters.

The committee also formulated 14 new questions for study by the Governments of the world, on subjects related to the foregoing. These will be considered at the next meeting, which is to be held in Lisbon, Portugal, some time subsequent to 1932.

STANDARDIZATION AT THE FOURTH PAN AMERICAN COMMERCIAL CONFERENCE

Furnished by L. S. Rowe, *Director General, Pan American Union*

Inter-American trade problems covering a wide range of subjects were discussed, and a number of important resolutions and recommendations were adopted at the Fourth Pan American Commercial Conference in session at the Pan American Union, Washington, D. C., from October 5 to 13. Delegates representing every Government of the American Republics and numerous chambers of commerce and trade groups from the various countries were in attendance. Addresses by the President of the United States, the Vice President, and other prominent officials, as well as by leaders in the business, economic, and financial world of the Americas, made the conference unusually important.

President Hoover, after stating that the theory of the United States is that "commercial enterprise, except as rare emergency action, is essentially a private undertaking," went on to say that "the larger significance of your meeting is attested by the fact that at stated intervals the accredited representatives of the Governments and of the commercial organizations of this continent come together with a view to interchange of experience and fostering that mutual confidence without which the development of international commerce is impossible."

Uniformity of specifications and standardization of commodities in inter-American trade have for years been receiving serious study, and special conferences have been called for discussion and solution of the problems involved.

The Fifth International Conference of American States, which met at Santiago, Chile, in 1923, realizing the importance and advantages of commodity standardization among the several republics, recommended the calling of a conference on the subject and the First Pan American Conference on the Uniformity of Specifications convened at Lima, Peru, in January 1925.

The outstanding recommendation of this conference was that which requested the Inter-American High Commission to draft an

inter-American convention for the establishment of uniform specifications and common nomenclatures in the American Republics in which the signatory countries should (1) agree to provide for the continuous study and establishment of inter-American standards, (2) agree to establish organizations for this purpose, and (3) oblige such organizations to adopt certain general uniform principles and practices.

In accordance with a resolution of the First Pan American Conference on Uniformity of Specifications, a second conference was held in Washington during May, 1927. This meeting discussed practical problems in the cocoa, coffee, fruit, hide, oleaginous seeds and wool industries, and initiated plans for a standardization program to be effected in all the American Republics. Among the resolutions approved by the conference were the following: (1) That the various Governments approve, at as early a date as possible, the project of convention formulated by the Inter-American High Commission; (2) that the Inter-American High Commission ascertain the condition in which exported Latin American products are most acceptable and carry on an educational campaign for the adoption in exporting of the manner of classification and packing indicated in order to obtain in the principal buying country the most advantageous conditions; (3) that a uniform nomenclature be adopted for identical products; (4) that a permanent committee be created composed of members of the Latin American missions at Washington; (5) that the system of classifying wool used in England and the United States be adopted in Latin American countries; (6) that a bulletin be established to further uniformity of specifications; and (7) that exporters in the United States adopt gradually the decimal metric system in exporting to Latin America.

The Sixth International Conference of American States recommended that—

the Inter-American High Commission shall at an early date address the organizations of importers and consumers of the United States who import Latin American products, with a view to obtaining all manner of data concerning the form in which the products at present exported in greatest quantities from each Latin American country to the United States is most acceptable, including full details relative to packing.

The executive council of the Inter-American High Commission shall furnish all such data to its sections in each country, requesting them to convey the same to the producers and exporters, through their organizations, with a view to the fulfillment of the recommendations they contain as far as possible at present, and the study of reforms necessary to standardize specifications, taking into account the conditions of the product in each place.

The creation is recommended of a Pan American Commission, to be formed of representatives of the organizations of consumers and exporters of the United States and of the organizations of producers and exporters of each Latin American country, and which will take up the study, at periodical meetings, of the best means of standardizing the specifications of each product, endeavoring to adopt therefor the metric decimal system, a uniform name in Spanish for the products of identic specifications, and to have the equivalent of such name in other languages used for the designation of the same product only.

The dates and places of meetings shall be fixed by the governing board of the Pan American Union, and the preliminary work of that commission shall be carried on by the governing board in cooperation with the Inter-American High Commission; and that adequate educational and propaganda work be carried on by the Governments, members of the Pan American Union, in collaboration with the sections of the Inter-American High Commission.

At the Fourth Pan American Commercial Conference, which held its sessions from October 5 to 13, the subject of standardization of commodities as an aid to commerce and the protection of producer and consumer occupied a most important part in the discussions which took place.

In opening the discussions on standardization, which were held in group 1 of the conference, the chairman of this group, J. Silva Herzog, who was also chairman of the Mexican delegation to the conference, called upon H. J. Besley,[1] Chief of the Grains Division, United States Department of Agriculture, to explain the methods employed in the United States in the classification of grains. J. A. Jauregui, delegate of the Museo Social Argentina, then spoke on the obstacles in the grade grain trade due to the irregularities which exist in grain standards, and offered a resolution to the effect that the Argentine Republic be advised of a method to be followed in the standardization of grains, inasmuch as the inter-American grain trade has become a very large one.

The work which has been done in the United States to protect the consumer, and at the same time to encourage industry and agriculture, was explained by Dr. A. S. McAllister, Assistant Director, Bureau of Standards, of the United States Department of Commerce.

Chile has taken a great interest in the subject of standardization of commodities, declared Ricardo Heatley, delegate from Chile, who pointed out that his country had formulated many regulations with respect to this subject.

C. V. Whalin,[2] Chief of the Livestock, Meats, and Wool Division of the United States Department of Agriculture, spoke on the standardization of cattle, meat, and wool products in the United States. He was followed by Wells A. Sherman, chief of the Fruits and Vegetables Division of the same department, who gave a résumé of the methods employed in standardization of fruits and vegetables.

Robert F. Martin,[3] of the United States Department of Commerce, supported the opinions expressed during the conference regarding the need of establishing fixed standards favorable to both producer and consumer. He referred specifically to the success achieved by the Haitian Government in the improvement of coffee from that country, the price of which increased from 3 to 40 per cent during the years in which the experiment of grading coffee has been in process.

Following these discussions, the chairman of group 1 appointed a committee to draw up a resolution on the subject under discussion. After careful study, this committee presented the following resolution, which was approved by group 1 and transmitted to the conference in plenary session, where it was unanimously approved:

The Fourth Pan American Commercial Conference resolves:

1. To recommend to the Governments of the American Continent that they make known the specifications, composition, and analysis of their agricultural and mineral products, which enter into their export trade.

2. To recommend to the American Governments that they subscribe to the draft convention formulated by the Inter-American High Commission for the

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[1] See "Grain Grading," by H. J. Besley, Commercial Standards Monthly, October, 1931.
[2] See "Standardizing Grades for Livestock and Meats," by C. V. Whalin, November, 1931, issue of Commercial Standards Monthly.
[3] See "Standardization of Export Products in Haiti," by Robert F. Martin, in Commercial Standards Monthly, December, 1930.

establishment of uniform specifications and common nomenclature in the countries of this Continent.

3. To reiterate to the Inter-American High Commission compliance with the resolution on standardization adopted at the Sixth International Conference of American States, held at Habana in January and February, 1928.

INTERNATIONAL STEAM-TABLE CONFERENCE

At the second international steam-table conference held in Berlin June 23 to 27, 1930, the skeleton table adopted in 1929 at London was revised and extended in the light of new experimental data and study. The values of heat content of saturated water and steam measured by the bureau in the range of pressure up to 800 pounds per square inch were adopted as definitive values.

The work of these conferences makes it possible to bring by successive steps the steam tables used in different countries closer to a common standard, the adoption of which is the ultimate object. The conferences aid in bringing out the regions of disagreement of values, thus showing where experimental work is of most importance.

INTERNATIONAL UNION OF CHEMISTRY

The tenth conference of the union was held at Liege, Belgium, in September, 1930. Its principal standardizing activities consisted in a reorganization of its committees as follows:

1. The council of the union adopted certain regulations regarding the personnel and methods of work of all its committees.

2. The former committee on chemical elements was discharged and replaced by three committees, as follows: (*a*) International atomic weight committee, charged with the publication of an annual table of atomic weights; (*b*) international committee on atoms, charged with the quadrennial publication of quantitative data concerning isotopes, atomic structure, and individual atoms in general; and (*c*) international committee on the constants of radioactivity, to serve as a liaison committee between the union and the "radium standard committee."

It was voted to suppress the present national tables of atomic weights as soon as the first report of the new international committee is published.

3. The committee on the international bureau of physicochemical standards was continued.

4. A new committee, the international committee on thermochemical data, was organized as a permanent international committee.

5. The international committee on annual tables of constants was continued, as were also the committees dealing with the nomenclature of organic, inorganic, and biological chemistry.

The union also voted to hold the Ninth International Congress of Pure and Applied Chemistry at Madrid, Spain, in April, 1932.

INTERNATIONAL SCIENTIFIC RADIO UNION

A general assembly of the International Scientific Radio Union was held at Copenhagen, Denmark, May 27 to June 6, 1931, the last previous meeting having been held at Brussels, Belgium, in 1928. The

Copenhagen meeting was simultaneous with the meeting in Copenhagen of the International Technical Consulting Committee on Radiocommunication.

The union has national sections in the following countries: Australia, Belgium, Denmark, France, Great Britain, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Union of South Africa, Switzerland, and the United States, most of which were represented at the Copenhagen meeting. The union has a permanent general secretary, whose office is in Brussels.

The Copenhagen meeting consisted principally of meetings of subordinate bodies called commissions. These commissions reviewed the status of radio science in their respective fields, which are:

I. Radio measurements.
II. Wave propagation.
III. Atmospherics.
IV. Cooperation.
V. Radiophysics.

Through the activities of these commissions, which are composed of specialists from all nations interested, cooperation is promoted on scientific radio projects. These include such matters as the study of radio-transmission distances, the nature and prevalence of atmospheric disturbances, the accurate measurement of frequency and field intensity, and the study of high-frequency current and radiation phenomena. The union also promotes the dissemination of bulletins giving current data on height of the Kennelly-Heaviside layer, terrestrial magnetism, solar radiation, sunspots, etc.

The union adopted plans for radio observations during the forthcoming polar year. These include measurements of the height and ionization of the Kennelly-Heaviside layer, the intensity and counts of atmospherics, and the radio-signal intensity at low and high frequencies.

FÉDÉRATION AÉRONAUTIQUE INTERNATIONALE

The Fédération Aéronautique Internationale (35 Rue François-1er, Paris, France) is an international union of national aeronautic clubs which has for one of its primary purposes the regulation of aeronautic contests so that records may be recognized internationally. The permanent secretary is Paul Tissandier. It has now affiliated with it the national aeronautic clubs of about 30 different countries. The National Aeronautic Association, Dupont Circle, Washington, D. C., is its representative in the United States.

The supervision of record trials is under the contest committee of the latter organization, of which Orville Wright is chairman and George W. Lewis, vice chairman.

Records pertaining to free balloons, airships, landplanes, seaplanes, gliders, kites, parachutes, and helicopters are recognized. For each of these aircraft, where inherently possible, records may be made for distance or endurance, distance in a closed circuit, distance in a straight line, altitude, and speed. These are divided into various categories. Thus eight categories are recognized for free balloons, depending on the displacement, and airplane records are divided into categories depending on the weight of the airplane and the loads carried.

In order that records may be internationally recognized, the aeronautic meet or trial must be sanctioned by the national club and conducted in accord with regulations. One of the conditions is that the pilot must have an Fédération Aéronautique Internationale license.

It will be necessary to describe only the technique involved in determining records for the highest altitude and the highest speed, since that for most other records is, with proper modifications, embraced in these two.

In an altitude trial the regulations in substance provide that the altitude shall be determined by the lowest pressure attained in flight. This pressure is to be measured by a sealed barograph carried in the airplane. This instrument must be prepared and installed by an official observer appointed by the national aeronautic club, hereafter designated as the National Aeronautic Association. It is required that the stylus of the instrument shall trace on a smoked chart, preferably of aluminum. After the flight the barograph must be tested at an official laboratory designated by the national club, which in this country is the Bureau of Standards. The regulations provide that the instrument shall be tested while at a temperature of 15° C. in a closed chamber, the pressure of which is varied so that the barograph pen retraces as nearly as possible the trace made in flight. The lowest pressure indicated is measured with a mercurial barometer. This lowest pressure is then converted into altitude by use of the Fédération Aéronautique Internationale standard atmosphere. The latter atmosphere should not be confused with the United States standard atmosphere, as they differ quite substantially. A record is made when the previous altitude record is exceeded by 200 meters.

The above procedure is modified somewhat at the Bureau of Standards in the interest of greater accuracy. The temperature of the instrument is controlled, as well as the pressure, so that the instrument temperature at the time the lowest pressure is reached in the closed container is the same as that in flight. This temperature is measured by a thermograph attached to the barograph base.

The length of the standard course for determining highest speed is 3 kilometers both for landplanes and seaplanes. The regulations provide in detail for the measurement of the course and the construction of the markers. This course must be flown four times, two times in each direction. The mean of these four speeds constitutes the speed. The regulations provide that the interval of time must be measured with a certified chronometer; that it must be recorded; and that the plane must be photographed, together with the sighting lines, at the time the observers operate the chronograph. Further, the altitude of the airplane must not exceed 50 m while flying over the course, which fact must be verified both by observers and by a barograph carried in the airplane.

In races and endurance flights the timers must use stop watches or timepieces which have been tested by an official laboratory. Time-pieces of the first class must pass a 50-day test roughly equivalent to the class A test described in Bureau of Standards Circular No. 392 and timepieces of the second class, a 34-day test roughly equivalent to class B test. A class A timepiece must be used to

secure recognition of records involving measurements of time less than 12 hours.

Provision is also made for the certification of weights used in flights made carrying a pay load.

THE PAN AMERICAN SANITARY BUREAU

Furnished by Dr. B. J. Lloyd, Pan American Sanitary Bureau, Washington, D. C.

The Pan American Sanitary Bureau is an independant international body charged with the duty of aiding in the protection of the public health of all the American Republics, particularly with regard to the prevention of the spread of communicable diseases in international commerce. It was created in 1902 by the First International Sanitary Conference of the American Republics, under authority of resolutions adopted by the Second (general) International Conference of American States, with offices in the building of the Pan American Union, Washington, D. C.

The present officers are: Honorary director, Dr. Carlos Enrique Paz Soldan, professor of hygiene, faculty of medicine, Lima, Peru; director, Dr. Hugh S. Cumming, Surgeon General, United States Public Health Service, Washington, D. C.; assistant to the director, Dr. Bolívar J. Lloyd, medical director, United States Public Health Service, Washington, D. C.; secretary, Dr. Sebastián Lorente, ex-director of public health, Lima, Peru; members—Dr. João Pedro de Albuquerque, National Department of Public Health of Brazil, Rio de Janeiro, Brazil; Dr. Solón Núñez F., secretary of Public Health and Social Welfare of Costa Rica, San José, Costa Rica; Dr. Ramón Báez Soler, Under Secretary of State for Health and Public Welfare, Santo Domingo, Dominican Republic; Dr. Justo F. González, professor of hygiene, faculty of medicine, Montevideo, Uruguay; traveling representative, Dr. John D. Long, United States Public Health Service.

The Pan American Sanitary Bureau has broad general powers, and, while more directly concerned with questions of an international character, it may undertake cooperative studies and sanitary work in any of the affiliated countries when this is desired by the authorities of the country in whose territory such studies or activities are to be carried out. The fact should be emphasized that the bureau does not exist for the purpose of standardizing health activities throughout the American Republics, though it has been found that in actual practice much of what it accomplishes does result in producing uniformity of action and standardization of procedures. It should also be noted that most of the bureau's activities are constant; that is, continuous in character, thus making it necessary to report progress rather than completion when describing its accomplishments.

During the past year progress has been made along the following lines:

(1) The adoption of more rational, more satisfactory, and more nearly uniform methods in administering international quarantine measures, particularly with regard to the regulation of aerial navigation.

(2) Improvement in the reporting of communicable diseases throughout the American Republics; by improved methods of tabulation and distribution, including publication of data in the Pan American Sanitary Bulletin, it is believed that health officers are better informed with regard to health conditions generally, and there is constant progress toward uniformity and standardization in this activity.

(3) The importance of securing safe water supplies, safe milk, and adequate sewage disposal and standard methods for accomplishing these objectives are constantly being brought to the attention of all health authorities through the medium of the Pan American Sanitary Bulletin.

(4) Interest has been aroused in the use of a standard nomenclature of diseases.

(5) Cooperative work in combating bubonic plague has been carried on in the Republics of Peru and Ecuador.

(6) Improvement has been noted in the sanitary condition of seaports, a number of which have been classed as clean ports, of class A, that were formerly infected with quarantinable disease.

INTERNATIONAL COMMISSION ON ILLUMINATION

The International Commission on Illumination consists of national committees in 15 countries. It maintains a central office at the National Physical Laboratory of Great Britain; the general secretary is W. S. Stiles. The secretary of the United States national committee is G. H. Stickney, Nela Park, Cleveland, Ohio.

Sessions of the commission are regularly held at intervals of three years. The eighth session took place at Cambridge, England, September 13 to 19, 1931. It was preceded by an International Illumination Congress, with meetings held successively in five different cities. At these meetings more than 100 papers on the theory and practice of illumination were presented, the commission sessions including meetings of 18 technical committees dealing with the following subjects: (1) Vocabulary, (2) definitions and symbols, (3) automobile headlights, (4) factory and school lighting, (5) heterochromatic photometry, (6) street lighting, (7) signal glasses, (8) diffusing materials, (9) photometric test plates, (10) photometric precision, (11) light flux distribution, (12) daylight illumination, (13) cinema lighting, (14) fundamental research on glare, (15) colorimetry, (16) applied lighting practice, (17) aviation lighting, and (18) lighting education.

The general purpose of these meetings is to exchange information and, when practicable to do so, to promote uniformity of practice among the different countries taking part. Among the decisions reached at this session those of greater general interest are as follows: In pursuance of its work on vocabularies of illumination the commission will attempt to issue a dictionary of equivalent terms in English, French, and German, with definitions in French; as a symbol for refractive index the use of n is recommended; in all official publications of the commission photometric quantities will be given in a system based upon the centimeter-gram-second units, and in publications using any other units it is recommended that equivalents in such a system be added; automobile headlights should be

capable of giving two forms of beam, (1) a driving beam and (2) a passing beam for use when meeting other vehicles, and an attempt was made to agree upon very general requirements for such beams; the commission repeats its former recommendation of minimum values of illumination permissible for various kinds of work and has now supplemented these by a list of higher values considered desirable both for the welfare of workers and for economical conduct of work; in colored signals for control of traffic it is recommended that red signals be placed at left or top, amber (when used) in the center, and green at right or bottom; a method of specifying the fundamental optical properties of diffusing glasses is suggested on the basis of technical papers presented at the congress; a very complete set of factors prescribing the visual characteristics of a "standard observer" for color measurements is established; as standard illuminants for colorimetry of materials, three sources are recommended, namely, (1) a gas-filled lamp operated at a color temperature of 2,848° K., (2) the same lamp with a Davis-Gibson filter as described in B. S. Misc. Paper No. 114 for converting the effective color temperature to 4,800° K., and (3) a similar combination with the filter designed to give an effective color temperature of 6,500° K.

With reference to aviation lighting, a list of equivalent terms in English, French, and German was accepted, and a considerable number of general principles were agreed upon to govern the establishment of beacons, the use of navigation lights, and the development of landing lights. In particular, it was agreed that eventually red shall be reserved exclusively for obstruction lights and shall not be used to mark the boundaries of landing fields as it has been used in Germany.

Some progress was also made toward the establishment of a uniform type of screw thread for lamp bases and sockets. Carrying forward a project initiated by the International Electrotechnical Commission, representatives meeting at Cambridge agreed to recognize three slightly different types of medium screw shells: (1) The long-established American thread; (2) a European standard thread somewhat deeper and longer; and (3) a new ideal standard approximately combining the European depth with the American length which it was hoped would eventually find general acceptance.

The commission decided to take up the study of radiations outside the visible spectrum (infra-red and ultra-violet) in so far as these are emitted by modern sources of light and are of interest to the illuminating engineer. The management of this study was assigned to the Dutch national committee. Other new subjects and the committees to which they are assigned are as follows: Effects of glare in street lighting, Great Britain; photometry of gas-discharge tube lights, Hungary; application of photo-electric cells in photometry, France; architectural aspects of illumination, France; production of artificial daylight, Sweden; effects of shadows in illumination, Germany; lighting of mines, Great Britain; organization of advisory service on lighting, Switzerland; effects of variation in voltage of lighting circuits, Italy.

A special committee was appointed to deal with the problem of photometric units and standards in collaboration with the International Committee of Weights and Measures. This special committee

includes representatives of France, Germany, Great Britain, the United States, Holland, and Japan. As an immediate step toward removing the present discrepancies between ratings of incandescent lamps in different countries, the national laboratories of the first four countries mentioned announced an agreement on a method for comparing tungsten standard lamps with the basic carbon-filament standards. This method is the use of color-matching filters for which the integral transmission is calculated from spectral transmissions by means of the visibility (luminosity) factors previously accepted by the commission. (See B. S. Sci. Paper No. 475; pp. 131–191, vol. 19, of collected Sci. Papers.)

The next plenary session of the commission was set for Berlin, Germany, in 1934.

INTERNATIONAL CONGRESS ON RADIOLOGY

The International Congress of Radiology, organized in 1925, meets every three years for the purpose of discussing general problems in Radiology. The past and future meetings are as follows: London, 1925; Stockholm, 1928; Paris, 1931; and Zurich, 1934.

There are two permanent commissions of these congresses dealing with the problems of standardization. The International X-Ray Units Commission deals particularly with methods of standardizing X-ray intensities and qualities, nomenclature, definitions, and methods of application. The International X-Ray and Radium Protection Commission has compiled a set of recommendations providing greater safety from harmful radiations and more healthful working conditions for full-time X-ray and radium workers.

The Bureau of Standards is represented on both of these commissions. At the Paris meeting, agreement was reached on standard methods for measuring X-ray intensities and qualities. The methods of measuring these quantities in the United States in the past few years conform to the latest agreements. The protection commission adopted recommendations largely from England and the United States, dealing with the use of X-ray film, high-voltage protection, and anaesthetic-room protection. Action on the adoption of an international X-ray standard was deferred until the 1934 meeting.

INTERNATIONAL AIR NAVIGATION AGREEMENTS

Italy and United States.—An air navigation arrangement has been entered into between the United States and Italy, effective on and after October 31, 1931, a summary of which is given below.

Civil aircraft (which excludes military, naval, customs, and police aircraft) of the United States may enter Italian territory upon strict compliance with the following conditions:

1. The aircraft is registered and passed as airworthy by the United States Department of Commerce and bears the allotted registration markings preceded by the letter "N," in accordance with the air commerce regulations of that department.

2. The journey log is carried by all aircraft and the aircraft log and the engine log by all aircraft assigned to public transportation of passengers and cargo.

3. The certificates of registration and airworthiness are carried in the aircraft.

4. The pilot is licensed in accordance with the regulations of the Department of Commerce and must carry the license.

5. No photographic apparatus is installed in the aircraft unless the Italian authorities give permission for the entrance of such apparatus.

6. No photographs are taken from the aircraft without specific authorization of Italian authorities.

7. The laws, rules, and regulations in effect in Italian territory governing the operation of civil aircraft must be observed.

Provisions similar to those briefly summarized govern the entrance of Italian civil aircraft into United States territory.

Other provisions of the arrangement relate to the licensing of pilots of American nationality by Italy and vice versa and the rights and privileges of pilots so licensed, the conditions under which air-transport lines of either country may be given permission by the other country to operate in its territory, and the acceptance by each country of certificates of airworthiness issued by the other country for aircraft and accessories exported therefrom as merchandise.

The United States is a party to other air-navigation agreements as follows:

United States, Panama Canal Zone, and Colombia.—By an exchange of notes identical in terms between the Secretary of State and the Minister of Colombia on February 23, 1929, an arrangement was entered into between the United States and Colombia governing facilities for commercial aircraft in the United States, the Panama Canal Zone, and Colombia.

United States and Dominion of Canada.—By an exchange of notes between the Secretary of State and the chargé d'affaires ad interim of the Dominion of Canada, dated August 29, 1929, and October 22, 1929, respectively, the United States and Canada entered into an air navigation arrangement providing for the admission of civil aircraft, the issuance of pilot licenses, and the acceptance of certificates of airworthiness for aircraft imported as merchandise.

United States of America and Other American Republics.—A multilateral convention on commercial aviation was adopted by the delegates to the Sixth International Conference of American States at Habana on February 20, 1928. The convention was approved by the Senate of the United States on February 20, 1931. The President's instrument of ratification, dated March 6, 1931, of this convention was deposited with the government of Cuba on July 17, 1931, in conformity with Article XXXIII of the convention, and the convention was proclaimed by the President of the United States on July 27, 1931. Pursuant to the terms of Article XXXIV of the convention, the convention came into force as between the United States and Mexico, Nicaragua, Panama, and Guatemala, the countries which had previously deposited their ratifications, 40 days from the date of the deposit of the United States' ratification, namely, on August 26, 1931.

INTERNATIONAL STANDARDS ASSOCIATION

From Report of General Secretary, Mr. Huber-Ruf

The International Standards Association is an international federation of national standardizing associations. Its objects may be summarized as follows:

To interchange information on the standardization work and activities in the different countries.

To develop general guiding principles for the assistance of the national standardizing bodies.

To promote uniformity among the standards of the various national bodies.

To cooperate with any international body engaged in standardization.

Member Bodies.—The standardization associations of the following countries are member bodies of the International Standards Association:

Austria.	Germany.	Poland.
Belgium.	Holland.	Rumania.
Czechoslovakia.	Hungary.	Russia.
Denmark.	Italy.	Sweden.
Finland.	Japan.	Switzerland.
France.	Norway.	United States.

Technical Committees of the International Standards Association.—To promote uniformity among the standards of the various countries, the following technical committees were formed:

ISA 1. Inch system.
1*a*. Screw threads.
1*b*. Bolts and nuts.
1*c*. Width across flats for the inch and metric systems.
2. Metric system.
2*a*. Screw threads.
2*b*. Bolts and nuts.
3. Limits and fits.
4. Ball bearings.
5*a*. Pipes.
5*b*. Fittings.
6. Paper sizes.
7. Rivets.
8. Shipbuilding.
8*a*. Ocean navigation.
8*b*. Inland navigation.
9*a*. Classification.
9*b*. Lists of standards.
9*c*. Progress reports.
9*d*. Conversion tables, quantities, symbols, units.

ISA 10. Drawings.
11. Test pressures for the acceptance of new stationary steam boilers.
12. Soil pipe.
13. Shaft height of machines.
14. Shaft ends.
15. Couplings.
16. Keys.
17. Steel and iron.
18. Commercial zinc.
19. Standard diameter series.
20. Aeronautics.
21. Regulations for sprinklers.
22. Automobile parts.
23. Agricultural machines.
24. Sieves.

The following new technical committees have been formed in 1930:

ISA 25. Cast iron and cast steel.
26. Metals, bronze, brass.
27. Coal.

ISA 28. Nomenclature and testing of petroleum products
29. Drills and other tools.

The following meetings were held in 1930:

January, at the Hague.
March, in Geneva (11 countries).
April, in Stockholm.
April, in Milan.
May, in Paris (18 countries).
September, in Vienna (12 countries).
November, in Prague.

At these meetings marked decided progress was made toward unified specifications in certain lines.

The secretaries of the national standardizing bodies of the various countries discussed at the meetings a number of very interesting questions such as: Steps for improving the methods of carrying out the national standardization work, and also the work of the technical committees of the International Standards Association; steps for facilitating the adoption of standards in practice and propaganda for standardization by means of publications, papers, exhibitions, etc.

III. NATIONAL STANDARDIZING LABORATORIES

(Governmental)

BUREAU OF STANDARDS

(Washington, D. C., United States of America)

(See Chapter VI)

The primary function of the Bureau of Standards includes the development, construction, custody, and maintenance of reference and working standards, and their intercomparison, improvement and application in science engineering, industry, and commerce. Most of the bureau's work is accomplished through voluntary cooperation of the Federal, State, and municipal governments; scientific and professional societies; trade associations; and other organizations concerned with the bureau's research results. The extent of this cooperative society is shown by the fact that with approximately 300 scientific, technical, and industrial organizations at the close of the fiscal year there were also 95 research associates, representing 45 industries and associations, at work in the bureau on research problems of interest to the industries concerned.

NATIONAL PHYSICAL LABORATORY

(Teddington, England)

Investigational work has been carried out for Government departments, boards, and committees of the department. The general program of more fundamental research and the maintenance of standards has continued under the supervision of the executive committee of the laboratory and its subcommittees. International cooperation on standards has been maintained. A full account of the activities of the laboratory will be found in the annual report of the laboratory for the year 1930 covering physics, electricity, metrology, engineering, metallurgy, aerodynamics, and the William Froude Laboratory. The laboratory has also issued a further volume of "Collected Researches" relating to electricity and wireless. The more interesting activities of the laboratory during the year 1930–31 are summarized in the following sections.

International Standards.—The program of work on international standards has been continued in the several departments of the laboratory concerned. The equipment for the measurement of the unit of length, the meter, in terms of the wave length of the red cadmium line is now complete, and preliminary observations have been started. The main difficulty of maintaining the temperature of the standard bar and of the inclosure constant to the high degree of accuracy necessary has now been successfully overcome. In connection with the international scale of temperature, an extensive inter-

comparison of temperature-measuring instruments is proceeding. Platinum-resistance thermometers, thermocouples, and optical-pyrometer lamps conforming to the international specification are being supplied and standardized by the national laboratories at Berlin, Washington, and Teddington. In addition, the low-temperature laboratories at Leiden are cooperating in measurements on resistance thermometers. The ampere balance has been reconditioned, as also has the Lorenz apparatus. The alternating-current method for determining the ohm has given a preliminary value of 1 international ohm=1.00055 cgs ohms. Intercomparisons of candlepower standards between the three national laboratories have also been made.

National Radium.—As requested by the National Radium Trust and the National Radium Commission, the laboratory has undertaken to test and distribute radium purchased by the trust. This involves routine gamma-ray testing, provision of facilities for the safe storage of the radium while in the possession of the laboratory, and the maintenance of full records showing the disposition of the material.

New Buildings.—Progress in erecting the central portion of the Physics Building made it possible to occupy it in February, 1931. The work transferred to this building comprises all the heat work formerly carried out in Bushy House and the acoustical work previously located in Victoria House, together with one or two items of X-ray work from Elm Lodge. The installation of the compressed air tunnel for aerodynamic research has also reached an advanced stage. A start was made early in 1931 with the erection of the new tank.

Physics Department.—Progress has been made on the thermal conductivity of single crystals of bismuth in a magnetic field. The use of a "bar" method has enabled a more compact apparatus to be constructed, so that field strengths as high as 23,000 gauss are obtained by reducing the air gap of the magnet. An improved method for producing single crystals of bismuth has been adopted. The temperature coefficients of thermal conductivity of single crystals of bismuth have been determined for heat flows perpendicular and parallel to the trigonal axis. The thermal and electrical conductivities of alloys up to temperatures of 800° or 900° C. are being investigated. Results are available for two varieties of stainless steel.

In the work on the stationary wave method of determining the ratio of the specific heats of gases, preliminary difficulties were overcome by using flexural instead of compression vibrations of the quartz crystal used as a source of sound. Satisfactory results were obtained for air and hydrogen up to 500° C. The work is being extended to high temperatures. Experimental work has been completed on the comparison of the wet and dry bulb hygrometers with the gravimetric and dew-point instrument for temperatures up to 100° C., and tables of moisture content in saturated air are being computed. The work program for the engineering committee of the Food Investigation Board includes heat transfer from a stream of air to cooled pipes, the drying power of air under various conditions, and a further study of methods of measuring humidity. For the atmospheric pollution research committee, the laboratory is measuring the free moisture in fogs. This work is now facilitated by new equipment for producing artificial fogs. Investigations for the Brit-

ish Electrical and Allied Industries Research Association include measurements of moisture movement in soil under the action of an applied temperature gradient and a further study of the thermal resistivity of the ground by the buried sphere method.

The radiology division has made measurements of X-ray intensity in *r* units, and on the scattering of X rays, a special X-ray tube having been designed and constructed for the purpose, so that it is now possible to study radiation scattered at angles up to 150° C. The energetics of X-ray production experiments are being studied for evidence as to the depth below the surface of the target at which X rays originate. Oscillograph records were taken of the behavior of various types of X-ray tubes under different conditions of excitation. The absorption correction for gamma rays of platinum and Monel metal was measured for the range of wall thicknesses employed in the metal needles, tubes, and applicators used in radium treatment. The application of X-ray crystal analysis methods to industrial problems has been studied, the problems covering transformer steels, tungsten-steel residues, grain size in steels, rolled aluminium, drawn wires, paint materials, etc.

The sound division has studied the transmission of sound by partitions, a beat-tone oscillator and coil-driven loud-speaker enabling a wider range of frequency to be used in the tests. The stationary-wave method of measuring absorption coefficients continues to be used for small samples of material, and a paper on the theory of the method has been published. Progress was made in measuring absorption coefficients by the reverberation method and instrumental methods are now used to measure reverberation time. A phonic chronoscope is started the instant the source of sound is switched off and is then stopped by a relay operated by the microphone amplifier when the reverberant sound has decayed to a predetermined intensity. The experiment is repeated for a different degree of amplification and the difference of the observed periods gives the time of decay of the sound energy by an amount depending upon the ratio of the amplification employed. Methods are being developed for sound measurement, for measuring absolute sound intensity, and for measuring the frequency response characteristics of gramophone "pick-ups." Work has been continued on the acoustical features of buildings and a paper prepared on "Building Acoustics in Relation to Talking Pictures."

The optics division has investigated optical systems, particularly in connection with Abbe's sine law and its extension to a wide field and large lens aperture. Color measurement and standardization has been continued. A number of ultra-violet absorption tests have been carried out. Improvements have been made in the instrument employed in wave-length determinations in the infra-red. The work on standards of total radiation has been widened by taking over the calibration of radiometers formerly carried out by the late Professor Callendar. This involved the establishment of the unit of radiation and the development of suitable methods of calibrating different types of radiometer in terms of the unit. For the atmospheric pollution research committee an instrument has been designed and constructed to record the approximate variation of energy distribution in daylight. Work has also been done on the

energy distribution in the ultra-violet region of the spectrum of daylight.

Electricity Department.—In the electrical standards and measurements division steady progress has been made with the program of work in hand. Measurements of the effective self-inductance and resistance of telephone loading coils have been extended up to a frequency of 10,000 cycles per second. For the volume leakage correction in measuring surface resistivity measurements of insulating materials, an experimental method has been devised. A method was found of compensating for the frequency error of alternating-current milliammeters incorporating copper oxide rectifiers. The magnetic properties of a full range of iron-chromium alloys were studied. Investigations on the power losses in dielectrics and on dielectric measurements at high frequencies were carried out for the Electrical Research Association.

The electrotechnics division continued to develop alternating-current measuring methods. Special attention was given the accurate calibration of current transformers having cores of nickel-iron alloys with small phase interval between the primary and secondary circuits. The change of temperature coefficient of resistance of copper-nickel wire on drawing and the correlation with structure as revealed by X-ray analysis were studied. The series of alternating-current 4-terminal resistance standards was extended and calibrated. The shielded resistor for 40 kilovolts has been completed, and has been put into use for voltage transformer tests. The measurement of high alternating voltages by the rectification of condenser current and by means of a condenser divider has been continued, and a paper was published. A study has been started of the depreciation of the surface insulating properties of insulators by contamination with smoke and fog. Investigations are in hand for the Electrical Research Association on the dielectric losses in cables at high voltages and on the heating of 3-phase transmission systems involving the use of three cables.

The photometry division has improved the equipment for photoelectric photometry, adding facility and accuracy. In heterochromatic photometry a method was developed to check the calibration of the standard lamp. Transmission factors for colored glasses and lenses were measured. Work was conducted on the use as a standard of light of a black-body radiator maintained at the freezing point of platinum. Improvements were made in the apparatus for measuring the brightness of radioactive luminous compounds.

Metrology Department.—In the metrology department the maintenance of line standards has continued. Four surveying wires from the International Bureau of Weights and Measures were compared with the laboratory standards and the discrepancy of 2½ parts in 1,000,000 found in 1928 still persists. Good progress was made in standardizing steel end gages in terms of the wave length of light. Temperature control of the standards was studied and modified in the mounting of the apparatus, overcoming uneven temperature distribution caused by heat loss through the concrete supporting pier. In connection with gage testing, certain cohesion phenomena were studied and an atomic theory of elastic hysteresis published. Confirming earlier work further experiments on the cohesion of quartz

fibers were carried out. A new shadow protractor for measuring screw threads was designed and constructed. A method has been devised for the rapid testing of surface plates to an accuracy of 0.0001 inch. The stability of hardened steel gages has also received attention. The primary standard barometer is completed and sources of error of the optical system examined theoretically and experimentally. Twenty-seven first-quality diffraction gratings were made by the Blythswood ruling engine. The performance of the Shortt clock has been particularly satisfactory. Progress was made in constructing the vibration clock and auxiliary equipment. A new form of reversible pendulum for an absolute determination of gravity is being made, and the correction due to the elasticity of the pendulum is being investigated mathematically. Research on pivots and jewels was continued, and new equipment permits more expeditious wear tests. In testing volumetric glassware and hydrometers and the production of specifications for this class of instruments, aid was given to the Empire Marketing Board, the Society of Public Analysts, the Standardization of Tar Products Tests Committee, and other bodies.

Engineering Department.—In the engineering department the general research on fluid motion has been continued. The flow of water in steady motion past flat circular plates normal to the direction of motion has been the subject of a communication to the Royal Society, and progress was made in a study of the wave length and velocity of travel of waves set up on the surface of water by wind blowing over it.

Static tests on gear teeth have been made, including measurements of the deflection of a tooth under various loads. In a research on hardness and abrasion tests a hardness test was developed for thin coatings of metal, such as electrolytically deposited chromium. A diamond scratch test in which the width of a V scratch is measured yielded promising results. Work on the stress distribution in reinforced concrete columns was continued. Other work dealt with the characteristics of boundary lubrication of surfaces under relative reciprocating motion, the mechanical properties of spring steel, and endurance tests on laminated springs and spring leaves, the mechanical properties of materials at high temperatures, the fundamental research into the phenomena of creep, the fatigue phenomena exhibited by single metallic crystals, causes of failure of lifting gear, wind pressures on roof and bridge structures, etc., concrete for roads, skidding with a motor cycle and side car for which further special braking equipment was designed, skidding tests with a small model 4-wheeled vehicle, and a research on wheel size and impact. For the latter a special accelerometer was constructed and subjected to a complete trial. Other work included tests on white-metal bearings, bending tests on insulator stator bars, observations on the stability of buildings of the Tower of London and on the vibration of the buildings of New Scotland Yard, and tests on vibration insulating materials.

Aerodynamics Department.—In the aerodynamics department the equipment has been in continuous use throughout the year. The general researches on fluid flow were continued. In the theory of flow in the boundary layer approximate solutions have been found for the boundary layer equations which can be applied to 2-dimen-

sional flow past bodies of any shape. An investigation has been undertaken to determine the intensity of friction on the surface of a large metal airfoil by measuring the velocity of the fluid close to the surface of the body. The drag of a circular cylinder of large diameter was measured in the duplex tunnel for high values of Reynold's number. Turbulence in wind tunnels by the hot-wire method was also studied. Further progress has been made with the study of air-flow problems by photographic methods. A new method makes use of the thin bands of hot air produced by fine wires electrically heated. Tests on complete models of multiengined machines have been made in the duplex tunnel. In these cases the tests are made with air propellers running. The study of airplane spinning was continued. In connection with air-screw research pressure and force measurements were made on a short streamline body in combination with a 4-bladed screw. Further work on airship models was carried out for the Airship Guarantee Co. (Ltd.), and for the Royal Airship Works at Cardington. Work on a model of *R101* was carried out by request of the Court of Inquiry into the *R101* disaster. Considerable attention was given to the flutter of airplane tails both from experimental and theoretical aspects. Experimental work was also carried out on air-propeller flutter. Among the new instruments developed is a micromanometer having a sensitivity more than ten times that of the ordinary Chattock gage. This new gage is adapted to measurements of velocity heads for air speeds from 20 feet per second downwards.

Metallurgy Department.—Metallurgy research on the physical structure of metals and alloys was continued. A study by X-ray spectrometer of certain intermetallic compounds of the copper-aluminium system showed at least two lattice structures, the existence of which had not hitherto been detected. These lie in the region between 20 and 30 per cent by weight of aluminium. X-ray methods have been applied to the study of a series of high purity iron-chromium alloys, of transformations in beryllium and of alloys of silver and mercury. In connection with the study of the nature of intermetallic compounds and of solid solutions and of their interrelationship the work on gold-copper alloys has been continued. For investigating elastic constants of brittle alloys a method using the velocity of sound in the specimen is receiving attention. Single crystals of various metals were prepared—aluminium, bismuth, antimony, and zinc. It was thought that it might be possible to obtain ductile crystals of antimony and bismuth by the use of very pure materials, especially if absorbed gases were absent, but in both cases only brittle crystals could be obtained. Further work has been done on the preparation of iron of high purity for the investigation of alloys including the iron-carbon system. The surface tension of mercury was studied between 0° and −37° C., while alloys of tin and lead were investigated between 500° and 240° C. The provisions of special refractories for use in the various researches was continued. The production of nonsilicious materials which will withstand high temperatures without reduction by hydrogen is of particular importance. Successful tubes of fusion glazed alumina were produced. Other researches dealt with light alloys; effects of surface conditions on the behavior of steel under fatigue; minor metals research, including beryllium,

cadmium, and titantium; causes of failure in lifting gear; alloys for use at high temperatures; alloys of iron research; impurities in copper, dental alloys, and amalgams.

William Froude Laboratory.—The demand decreased from firms for test work in the Alfred Yarrow tank, and opportunity was used to advance the program of research. Four ship designs have been improved by 25 per cent or more, five others by 9 per cent or more and of the remainder eight vessels have been improved between 5 and 3 per cent. Work on the influence of waves on the resistance, propulsion, and pitching of ships was extended to the action of the propeller in rough water in order that a complete account of the power required to drive the vessel could be produced. Experiments have been made on the wind resistance of ships, by towing a model of the hull and superstructure upside down through water, the immersed portion corresponding to the above-water portion of the ship. The tests showed that if the form comes within the limits tested, so that the "equivalent" transverse area can be estimated, the value of the resistance and its line of action can be calculated for a wind of any intensity or direction. A comparison of the water results with direct air effects was made by floating one of the models in a tank on a tower at the height of 60 feet above the ground and there measuring the resistance in winds of 25 to 30 miles an hour. The mean results agreed within a small percentage. Model research work on the maneuvering of ships, covering the use and design of unbalanced rudders on single and twin screw ships, was completed during the year. Progress is being made with the screw-propeller research. In the wake and friction research a comparison between the frictional belt of the ship *Ashworth* and its model was completed, and a start has been made on determining the frictional wake belt in the after body of a ship. Interesting comparisons were made during the year between model and actual ship data for two cross-channel types of vessel. Publication has been made of the experiments on the resistance and form of towed barges. The calculation and experimental measurement of the wave resistance of two unsymmetrical models was completed and published.

PHYSIKALISCH-TECHNISCHE REICHSANSTALT

(Berlin, Germany)

During the year ending June 30, 1931, there were tested 256 radioactive preparations for medicinal use, as well as weak radioactive materials, such as ores, emanators, and the like. The emanation standards (standard radium solutions) were continually checked and 55 calibrated standard radium solutions were distributed.

Researches on the shattering of the atom were carried out on boron. In bombarding several light elements with alpha rays a very hard gamma radiation of extremely low intensity was found, which obviously arises from the impacted nucleus, in part in connection with its disintegration. A characteristic gamma radiation of polonium hitherto unknown was found. In a northern expedition undertaken with the financial support of the Notgemeinschaft der Deutschen Wissenschaft and the Hamburg American Line, it developed that

the ultra radiation between Hamburg (51° north latitude) and the ice limit (81° north latitude) has the same intensity to within 5 per cent.

Mechanics and Sound.—The principal work of the laboratory for precision mechanics dealt with the further development of the testing equipment for taper threads. A method was worked out for testing taper internal threads up to 6 inches in diameter, which depends upon the casting process with the application of copper amalgam. The thread was reproduced well by the casting so that the determination of the half-angle of the thread relative to the perpendicular to the axis offered no difficulty; likewise, the pitch and taper can be measured with the required accuracy.

Following the methods of the Bureau of Standards in Washington accurately ground cylinders with angle points of 60°, 60° ± 4′, 8′, 12′, 16′, 20′, 30′, and 40′ were produced to complete the available equipment. The angle measurement is obtained by an optical matching with an accuracy of ± 3′, wherein the measuring cylinder is laid in an accurately ground V block, and the angle point is introduced into the thread.

The method for rapid determination of the pitch, likewise taken over from the Bureau of Standards, was altered in that a Goerz indicator, made especially for the purpose, was applied in the place of a dial indicator, and the readings of which depend on the deflection of an elastic spring.

Cyrogenic Laboratory.—The helium supply was increased by the separation of the neon-helium mixture furnished by the Linde Co. The separating equipment was improved, so that in one day a cubic meter of neon-helium mixture can be easily separated. The investigations on supraconductivity were extended, especially complete series of alloys being investigated.

Investigations were carried out on the transmission of slow electrons through tin foil above and below the critical point.

Furthermore, the dependence of contact potential on temperature, the contact resistance between very pure nonsupraconducting metals at the lowest temperatures and the effect of extremely low temperatures on pathogenic fungi, yeasts, and bacteria were investigated.

The investigations on the magnetic moment of the lithium atom were completed; similar measurements on the magnetic moment of potassium were undertaken.

Weights and Measures.—In the laboratory for length measurements numerous measuring devices were tested and certified. As a result of thorough detailed investigations significant advances were attained in the instrumental arrangement and technique for the accurate measurement of meter bars in terms of wave lengths of light. These advances consist in the application of a special new type of interference equipment in the determination of the fractional parts of a fringe by measurably altering the air pressure, and in the remote control of all coarse and fine movements by the observer. For the interference measurements excellent service was obtained from a cadmium lamp produced by the Studiengesellschaft für Electriche Beleuchtung m.b.H Osram, Berlin, which greatly excels in service life, constancy, and simplicity of operation the cadmium lamps

hitherto available. A new method for the exact determination of the refractive index of air was tried out.

The German measurements of the 24 m invar wires for the International Bureau of Weights and Measures, at Sevres, have shown that the invar wires lengthen with time. This result has been corroborated by all other international measurements made known. The German measurements fall in excellent agreement within the measurements of the National Physical Laboratory at Teddington, so that for an invariable measure of 24 m length the agreement between the English and German measurements is estimated to be within a few microns.

Two new designs of manually operated wire-measuring instruments were tested. Two new designs of fabric-measuring machines intended for the retail trade were admitted, and comprehensive investigations of leather-measuring machines were taken up. The Stephan paper strips, used exclusively, in the textile industry for length indicators, were tested for the dependence of the measured length upon the humidity and tension and accepted as testworthy.

In the weights laboratory numerous sets of analytical weights were tested, and the type tests and comparisons of grain testers begun in the previous year were continued, especially with reference to the standard tester of German origin found abroad.

The regulations relative to the construction and testing of beam scales, as well as the testing of track scales of the highest capacity or of special construction, were extended. In the field of scales with weight-indicating arrangements, new constructions were investigated and admitted on probation for testing.

The other investigations and determinations related to scales for the most varied purposes, for example, double scales for weighing of aircraft, scales with auxiliary arrangements, automatic disengaging arrangements, as for weighing bed feathers, devices for counting pieces of work of the same kind by weighing, coin-operated works of person weighing scales, scales for the determination of starch content of agricultural produce, etc.

The regulations regarding the testing of automatic beam scales were further set out. The type testing of scales for the automatic weighing of packing materials of the greatest variety, and of other automatic scales was continued.

In the laboratory for hydrometry, measuring devices for scientific and technical investigations and medicinal syringes, the relation between density and percentage of lime solution was investigated. Further investigations were undertaken to find out the accuracy with which density determinations by means of the pyknometer, especially with small pyknometers, may be made. A table was also calculated for converting the readings of a saccharimeter adjusted to 27.5° to values for saccharimeters adjusted to 20°.

A method was worked out for testing glass hydrometers designed principally for sea-water investigations. The testing activity covered hydrometers of all kinds, burettes, pipettes, butyrometers, medicinal syringes, and other instruments.

An apparatus for determining the starch content of potatoes was investigated for acceptability for test. Investigations on classifying sea water by physical properties other than density were

continued and concluded. Proposals for admitting gas meters, partly newer types, partly new forms of construction, were worked out.

New types of liquid-measuring apparatus were investigated. The experimental testing of such measuring apparatus; namely, automatic delivery-measuring devices for liquid motor fuels and the flow meter, necessitated the construction of special testing equipment. Considerable progress has been noted in the construction of piston metering devices for measuring lubricating oil and in the construction of tank cars with calibrated containers for the servicing of fuel supply stations. The regulations were further developed.

Electricity and Magnetism.—In regard to the international standardization of copper a revision of the standards was necessary. A new standard was worked out on the basis of the necessary measurements of the specific resistance of soft and hard copper of widely differing cross sections and also of tinned wires.

For the absolute determination of the emf of standard cells, check silver voltameter measurements which exhibited excellent agreement were made in June, 1930, in response to a decision of the Consulting Committee on Electricity, consisting of the representatives of the Bureau of Standards, the National Physical Laboratory, and of the Physikalisch-Technischen Reichsanstalt.

For absolute current measurement a part of the required equipment is completed.

The metallurgical investigations relative to the allotrophy of the elements (Si, Ti, explos. Sb) were continued, likewise those relative to magnetostriction.

For the measurement of capacity and of the power factor of large condensers a bridge method (Schering bridge) tried out earlier was further perfected.

Further, the working out of a bridge method for measuring time constants of high resistances was undertaken.

The sensitivity of the Giebe bifilar bridge used in carrying out the routine tests of small inductances was so greatly increased by an amplifier that self-inductance and resistance tests could be carried out at high frequency even with current strengths under 0.1 mA, which is important, for example, for the investigation of Pupin coils.

The activities in setting up a new frequency scale were advanced. The equipment for measuring the frequency of the standard tuning fork was improved, the frequency for a measuring time of 15 minutes is measurable to $\pm 0.5 \times 10^{-6}$. The investigation of the longitudinally vibrating light resonators gave a constancy of about ± 5 millionths in the frequency.

The cylinder guard-ring condenser developed in the Reichsanstalt for the testing of cable-insulating oils at high alternating voltages was technically so far advanced in construction that the investigation instead of being limited to 80° can now be carried out up to temperatures of 150° C. Likewise the voltage range has been extended from 45 to 60 kv.

For the Schering high-tension loss measuring bridge, a multiplying arrangement was developed which improves the accuracy of the

bridge by about 10 times, especially for measurements at low voltages.

For investigations at high voltage and high frequency, a tube generator with tube capacity of 1.5 kw has been built. The sender works best at about 70 kHz. With the Telsa coils used, a high-frequency voltage of about 100 kv was attained.

The compensating arrangement for measuring ionizations was further improved by the introduction of a tube voltmeter in place of an electrometer.

With very hard Röntgen rays (up to 400-kv tube voltage) measurements were carried out on the variation with the wave length of the screening coefficient for lead, between $\gamma=0.12$ and 0.02 Angstroms.

Investigations were taken up to find to what extent absorption measurements with very sensitive dosage meters are adapted to determining the voltage of Röntgen tubes.

On October 1, 1931, the Röntgen laboratory will institute routine type tests on Röntgen tube holder to decide whether these fulfill the German regulations for radiation protection.

The continued comparison of the differential method with the absolute method for determining the loss factor of dynamo and transformer plates (according to Siemens and Halske) has shown that the relative measurement gives the same accuracy as the absolute. On this basis, the testing of loss standards of industry is now being done with each of the three standards of the Reichsanstalt. For verifying the latter, new absolute measurements as well as comparisons of all standards of the same kind with one another were carried out and the values adjusted.

In common with a steel and rolling works the question was taken up whether simple magnetic measurements, especially those of coercive force can serve in industrial control in the construction of dynamo and transformer plate.

In a modified friction test machine of Mohr and Federhaff, Mannheim, the orientation effect and the moment of friction were measured in the range of limiting lubrication. This showed that the beginning of the orientation effect and the friction minimum enter at the same film thickness; that therefore, the orientation effect is characteristic of the limiting lubrication.

The piezo-electric method of registering suddenly changing pressures was applied to the measurement of rotational acceleration of motors, to the measurement of vibration forces of a Shenk fatigue-testing machine, and for the measurement of extensions and small displacements. Thus, for example, the movement of a shaft in a plain bearing with a radial clearance of 15 microns could be registered. For the investigation of combustion motors a piezo-electric pressure indicator was developed which can be screwed directly in the spark plug opening of the motor to be investigated and it is so constructed that with the heating of the motor no disturbing pressure forces enter.

In continuation of the investigations on the physical properties of metal crystals the elastic constants of the hexagonal magnesium crystal at room temperature, both for the directions parallel and transverse to the hexagonal axis, the specific resistance at 18°, their temperature coefficients between 0° and 100° and the thermal expan-

sion coefficients in the interval +18/+100° and +100/+200° have been determined. Furthermore the elastic constants of single iron crystals were determined.

Heat and Pressure.—In this division many observations were carried out in the comparison of temperature-measuring apparatus which had been exchanged by the various national laboratories. This includes resistance thermometers for the range from −183° to +660°; thermocouples for the range 660° to 1,063°; and tungsten filament lamps for the comparison of the optical temperature scale above 1,063°. The measurements with the thermocouples are complete.

Oil samples were exchanged with the Bureau of Standards to intercompare the standards of viscosity.

In connection with the measurements mentioned in a former report on the expansion and the pressure-coefficients of gases, a research arrangement was utilized with which the pressure was established by platinum points sealed into the tube of a mercury manometer. Since a greater accuracy is possible with this arrangement than with the customary method, this principle was used for measuring anew some important thermometric fixed points with the helium thermometer (container volume 120 cm^3). Conversions to the thermodynamic temperature scale gave for the standard boiling point of hydrogen −252.78°, of oxygen −182.96°, carbon dioxide −78.48°, and for the freezing point of mercury −38.83°. From these measurements it was concluded that the internationally accepted relation for the platinum-resistance thermometer, with two of the instruments conforming to the regulations, gave the carbon-dioxide point about 0.05° and the mercury point about 0.03° too low.

The triple point of nitrogen was found according to a new measurement to be 210.07° and 93.93 mm mercury pressure. For the triple point of oxygen −218.92 and 1.2 mm mercury were obtained. This last measurement was carried out with a new type of thermostat, the principle of which depends on the fact that hydrogen is conducted into or withdrawn from a vessel filled with carbon or chabasite according as heating or cooling is required.

A steam-pressure thermometer was constructed which is adapted for measurements by the statistical method up to 400°. The thermometer is connected with a mercury manometer, and consists mainly of a heated glass membrane on one surface of which the steam pressure acts, while on the other surface an equal air pressure operates.

Measurements with platinum-resistance thermometers were made with an accuracy of 0.1° up to the melting point of gold. In order also to represent in this region the resistance as a function of the temperature, it is necessary to add a small term containing the third power of the temperature to the Callendar quadratic equation.

Researches were started to make the photo-electric cell applicable to the measurement of incandescent temperatures. The black-body temperature of incandescent tungsten was investigated in the neighborhood of 2,000° C. in the visible region as a function of the wave length, and it was established that, in general, the energy distribution can not be given by a definite color temperature, that instead of the reciprocal value of the color temperature a linear function of the reciprocal wave length must be introduced.

From absorption measurements of carbon dioxide at 2.7 microns and at temperatures of 530° and 910° it was calculated that in the range of the bands under investigation, a layer thickness of 5 cm and about 1,000 mm pressure of carbon dioxide emits respectively 1.2 and 2.2 per cent of the total radiation of a black body at the same temperature.

A new absolute pyrheliometer was constructed, consisting of duplicate black bodies as radiation receivers of which one is warmed by sunlight and the other by electrical energy. Both black bodies were set at the same temperature increment, which was determined by a differential thermopile of 30 copper-constantan elements. The first investigation with this instrument consisted of the comparison with secondary instruments for measuring the solar radiation. The results were satisfactory.

Optics.—A new design of monochromator with simple quartz elements was developed in which the ocular slit can be changed rectilinearly from 0.19 to 3.5 microns. Further, in connection with a new alloying principle new radiation thermocouples with enhanced sensitivity and speed of manipulation were developed, in which receivers up to 0.2 thickness can be obtained by local diffusion without soldering. Besides, there were produced highly plane metal reflecting films of 0.07 micron thickness for étalon investigations and acoustical problems. Further investigations related to the advantages and applications of infra-red radiation for signaling in fog; and also to the spectral comparison of the newer photocells for use with the Warburg light unit.

Comprehensive measurements made on the strain in good optical glass plates should give information as to what requirements, with respect to double refraction, optical blanks must satisfy for corresponding finished articles.

The systematic comparison of steel balls from 3 to 13 mm diameter from 11 different domestic and foreign firms, as to quality (departure from the average diameter among themselves and roundness of the individual balls) has yielded data on what errors are to be regarded as admissible for the best balls.

With the cooperation of the firm of Halle Nachfolger, excellent Michelson échelon gratings have been produced from the standpoint of both transmission and reflection (in air as well as vacuum). The cooperation of the Reichsanstalt was offered for the purpose of obtaining information on the greatest error which the plate can have and yet furnish a good working grating.

A new method for measuring excitation potential was worked out. This led in the current year to the measurement of the excitation potentials of band spectra and it was possible with the aid of this to coordinate an interval in the excitation potential of the continuous spectrum of H_2 with the wave length. With the same method it was possible under the circumstances to observe metastable terms and resonance spectra.

The multiple interference apparatus was completed and with its aid investigations of the interference of light were carried out.

NATIONAL LABORATOIRE D'ESSAIS

(Mécaniques, Physiques, Chimiques, et de Machines)

(Paris, France)

(Du Conservatoire National des Arts et Métiers, Paris, France)

The Laboratoire d'Essais is located in the Conservatory of Arts and Crafts and attached to the Ministry of Public Instruction and Fine Arts (Under Secretary of State of Technical Education). A technical commission of 23 members controls its work. It is the National Testing Laboratory of France for various kinds of materials and machines. It comprises, at present, a personnel of 192 members. Its work is divided into six departments—physics, verification of instruments of measurement, metals, materials, machines, and chemistry.

For the year ending August 31, 1931, 4,115 requests for tests have been met, namely, physics, 604; verification of measuring instruments, 165; metals, 1,068; materials, 926; machines, 141; chemistry, 1,211; total 4,115.

Physical Tests.—Investigations undertaken the preceding year on the "determination of coefficients of thermal conductivity of insulating and refractory materials" have been continued in 1930–31.

A new tubular apparatus has been designed and constructed by the Laboratoire d'Essais for the "determination of thermal conductivity of heat-insulating products" as applied to cylindrical conductors.

Trials relating to the measurement of characteristics of sound have been carried out. A device has been established permitting (1) the emission of a series of sounds, as pure as possible, of a determined frequency and intensity; (2) the transformation of acoustic phenomena into electrical phenomena; and (3) the determination of the characteristics of the electric phenomena before and after the passage of sound through a material, and without interposition of this material between the sounding source and the receiver.

Very recently, M. J. F. Cellerier, Director of the Laboratoire d'Essais, has perfected an apparatus for the study of noises in the interior of rooms, whether the noises come from within, whether arising from the outside, from machines, or singing voices.

The special feature consists of the separation of the noises emitted by different sources and, for precise measurements, the separation even of different harmonics of a given noise.

The laboratoire had constructed a special ice calorimeter, provided with a guard ring, for the determination of the specific heat of bodies. The apparatus thus protected will avoid all corrections: it will permit working on a considerable volume of the specimen and consequently obtaining high precision.

Finally, the laboratoire has studied the absorption spectra of different liquids, notably of sterols in ether or absolute alcohol, in the ultra-violet region between 2.300 and 3.900 A.

Verification of Measuring Instruments.—This department verifies measuring apparatus, such as thermometers, alcoholometers, densimeters, ebulliscopes, volumetric glassware, etc. It carries out the legal verification of clinical thermometers, 743,730 of which, mainly

of French manufacture, were tested by the laboratorie from January 1 to August 31, 1931.

The study relative to the definition of the acetimetric degree of vinegars and of the method to follow in determination of this degree, undertaken the preceding year in collaboration with the Service des Essais de Chemie, ended in an intersyndicate convention of the companies interested (Syndicat des Fabricants de Vinaigres de France et Syndicate divers de l'Epicerie).

Test of Metals.—Photomicrography in polarized light and the examination of microchemical reactions on pigments, carried out in 1931, led to the development of a comparator microscope which allowed the simultaneous examination of two pigments, of which one is chosen as a standard. By noting the tint for which these pigments are transparent or opaque, small variations in tint can be detected with precision and measured roughly, so that specimens can be identified or their source determined.

Special tests carried out may be cited: Test of piercing and cutting with different types of blowpipes, of steels termed "antiblowpipe" to determine the time and mode of operation necessary for the perforation or fusion of the plates of strong boxes; compression tests of assemblages for panel frames of bridges; static and dynamic tests of wheels of automobiles and airplanes; tests of fibers from colonial plants; examination by polarizing microscope of thin sections of porcelain or of faience for sanitary equipment (these examinations show in the amorphous magma the actual presence of crystalline aggregates susceptible of creating a heterogeneity harmful to good service after burning); macrographic and micrographic examination of castings subjected to heat treatments, sections of guns, of cupronickel, of metallic joists, of sections of broken axles, of a rolling mill cage, of special bronzes for condenser tubes.

Tests of Structural Materials.—The Services des Essais de Materiaux de Construction has not been able to undertake technical researches or special studies in addition to the numerous tests demanded of it. On the other hand, it has proceeded with a number of relatively important special tests, among which attention may be called to tests of the resistance to burning of different materials, notably of cork, and of flagging of magnesite brick for jointless floors and, finally, tests of fabrication of silico-calcareous brick.

Special tests have been carried out, notably on laminated pontoons for airplanes with a view to examining their resistance to tension, flame, and shear.

A study of a general nature is being carried out concerning means of preservation to be adopted for conserving natural stones used in construction.

Test of Machines.—Besides current tests, on different internal combustion engines, gear reductions, of fuels and carburetors, belts, compressors, joints for pipes for high-pressure steam, smoke consumers, etc., the service has started this year tests of radiators, of boilers, of pneumatic hammers and of high temperature heat insulators. These methods of test are described in Bulletin No. 23 which has just been published.

Chemical Tests.—Tests identical with those of other years have been required: Analysis of all kinds of products with respect to metals and

alloys, materials of construction, lubricating materials, combustible solids and liquids, paints, rubber, vegetable materials, etc. A certain amount of work is to be noted on corrosion, boiler compounds, antiscale products, inks, antifreeze products, vinegars, tars, etc.

As stated under the subject of "Verification of Measuring Instruments" the Service des Essais de Chimie has finished, in collaboration with this service, the important study requested by the Syndicat des Fabricants de Vinaigre de France, which ended in drawing up an intersyndicate convention.

The Service des Essais de Chimie has studied the problem of determining the relative proportions in mortar or concrete of cement or hydraulic lime, which is of the greatest interest to the building industry.

M. Maitre-Devallon, Chief of the Service des Essais de Chimie, has perfected a method of directly determining the hydrated silica which permits solving the problem with an order of precision of 5 per cent maximum, which gives for ordinary concrete a total maximum error of 15 to 20 kg per cubic meter.

Standards.—Studies relative to standardization continue to develop actively in France. At present, norms studied technically by private organizations or technical services of the State are examined by a central organ fixed by the Association Française de Normalisation, or special commissions are constituted comprising representatives of the industries interested, technicians, representatives of special laboratories and representatives of the Laboratorie National d'Essais.

In this capacity, the National Laboratorie d'Essais du Conservatoire des Arts et Metiers helps to draft technical specifications for different materials (metals, materials of construction properly speaking, different materials, solid and liquid fuels, etc.)

Standardization of Industrial Zinc.—The commission for standardization of industrial zinc, presided over by M. J. F. Cellerier, Director of the Laboratoire d'Essais finally agreed upon specifications for zinc ingots and sheet. The details of these specifications relate to the creation of 5 classes of zinc defined as follows: Class A, standard greater than or equal to 99.9 per cent; class B, standard greater than or equal to 99.7 per cent; class C, standard greater than or equal to 98.5 per cent; class D, standard greater than or equal to 97.75 per cent; class E, standard greater than or equal to 97.00 per cent. For each of these classes the proportions of maximum impurities are defined.

Tests comprise: (1) For zinc ingots—(*a*) tests of textures, (*b*) chemical tests; (2) for zinc sheet or strip—(*a*) bending tests, (*b*) stamping tests, (*c*) chemical tests; (3) for zinc strip or plates—chemical tests. The method of sampling as well as the results to be obtained in the tests, are both specified in detail. Finally, the tolerances in dimensions, in thickness, and weight are defined.

In an indicative capacity, the commission has retained the table of numbers of zinc sheet from No. 1 to No. 26 for different thicknesses in millimeters.

The present specification has been submitted to public hearing and will be presented to the official plenary commission on standardization probably in October or November, 1931.

Standardization of Sheet Carbon Boiler Steel.—The committee on specification of sheet carbon steel for boilers has agreed on specifications for carbon-steel boiler sheet.

Tests for acceptance comprise: (1) Obligatory tests—(*a*) tensile test, (*b*) cold-bending test, (*c*) cold-bending test after tempering (for plates of grades 1, 1½, and 2); (2) contingently, when the order provides—(*d*) impact tests on notched bars (resilience), (*e*) tests of sulphur and phosphorus content, and (*f*) macrographic tests.

The specifications define the selection and dimensions of test bars, proportion of tests, thermal treatment of test bars, etc. Details of the results to be obtained in the tests are specified for tensile tests, cold bending, bending after tempering, resilience, macrography, and chemical analyses. In every case for tests of resilience a special commission defines the mode of operation as well as limits to adopt.

LABORATOIRE CENTRAL D'ÉLECTRICITÉ

(Paris, France)

Electrical Standards.—In 1930 the laboratory began a new determination of the electromotive force of the cadmium standard cell on the basis of the silver voltameter. A standard of mutual inductance has been prepared for use in the determination of the absolute value of the ohm.

Photometric Standards.—Comparisons of the primary standards of luminous intensity have been made with the Bureau of Standards as well as comparisons of the standards of luminous flux. Studies are in progress to determine the cause of the divergencies which manifest themselves in the latter comparisons. New standards of luminous flux have been realized by using the photo-electric cell in place of visual methods.

Measurements of High Tension.—A new type of noninductive resistor has been studied for measuring tensions as high as 400,000 volts and for the study of instrument transformers.

Measurement of Heavy Currents.—A new device for measuring heavy currents based on modifications produced by a direct-current magnetization in the properties of instrument transformers has been perfected during the year 1930.

Photometry.—The Laboratoire Central has been charged by the Ministry of Public Works with studies relative to the standardization of lamps for automoble headlights.

Studies Outlined for 1931.—In the course of the year 1931 researches relative to the determination of the ohm in absolute value will be carried on, to be followed by the preparation of a new standard of inductance.

NATIONAL RESEARCH COUNCIL

(Ottawa, Canada)

The National Research Council of Canada was organized during the World War. It is intended to perform in Canada the joint functions of the Bureau of Standards and the Mellon Institute in the United States.

Until 1929 the council's work proceeded along three main lines: (1) the encouragement and assistance of research in laboratories

already established; (2) the coordination of research on problems of national importance, such as tuberculosis and grain rust; and (3) the training of research investigators by the granting of postgraduate scholarships.

In 1931 more than 100 investigations assisted by the research council were in progress in 10 Canadian university and in 15 Government or industrial laboratories in Canada. Included in this number were such investigations as the effect of low temperatures on steel castings, causes of fermentation in honey, factors governing milling and baking quality of wheat, action of bacteria and enzymes on carbohydrates, the lateral support of steel columns and struts, the welding of steel structures, and the action of alkali water on concrete.

Under the scholarship program, 284 students had completed their postgraduate training.

The coordination of researches has been effected through associate committees of the National Research Council, the membership of which includes representatives of the cooperating laboratories and others interested. In addition to the two mentioned, the following are research committees that were in existence in 1931: Aeronautics, animal diseases, apple slacks, asbestos, coal classification and analysis, electrical measuring instruments, grain, heating and insulation, helium, honey, laundry, leather, magnesite, natural gas, radio, weed control, and wool. The main committee of the Canadian Engineering Standards Association is an associate committee of the council. The work of the committee on tuberculosis has been chiefly on a vaccine of the Pasteur Institute, Paris, radiology, pasteurization of milk, and the dissociation of tuberculosis bacilli. The associate committee on field crop diseases expects that a rust-resistant wheat of high milling and baking quality and early maturity will be available for distribution to Canadian grain growers within three years. The associate committee on coal classification and analysis includes representatives of the Federal and provincial departments of mines and of the coal industry. This committee has been working in close cooperation with the similar committee in the United States. In November, 1931, members of the Canadian committee met in Pittsburgh at the time of the meeting of the American committee.

The nucleus of a research staff was gathered at Ottawa in 1929, and early in the following year construction of a new National Research Laboratories building was commenced. To date the Dominion Parliament has voted $3,500,000 for building and equipment costs. Approximately 250,000 square feet of floor space is being provided. It is planned that the work of the National Research Laboratories shall comprise at least five divisions—biology and agriculture, chemistry, engineering, physics, and standardization. The building will be occupied early in 1932. At the end of 1931 the total staff of the National Research Council numbered 112, and the professional staff numbered 50. In quarters already available researches were being conducted in aeronautics, agriculture, chemistry, and physics.

Aerodynamic Laboratory.—Construction of the wind tunnel and installation of the equipment is nearing completion. The tunnel is of the open-jet, double-return type, constructed largely of reinforced concrete. The nozzle diameter is 9 feet and the free air stream 13 feet long from end of nozzle to entrance to collector. The propeller

is of duralumin, 4-bladed, 13 feet in diameter and is directly connected to a 600 h. p. variable-speed electric motor. Air speeds as high as 150 m. p. h. have been attained. The power factor is approximately 0.38. Adjustments and calibration of the tunnel are proceeding. Aerodynamic balances are now under construction.

A study of the design of corners in fluid channels, with particular reference to the form and arrangement of guide vanes in the corners of wind tunnel passages was made. A form of vane was devised, simple and economical to construct and resulting in satisfactory airflow conditions.

Test Tank.—Construction of the tank for the testing of aircraft floats and hulls is complete and installation of the carriage, carriage drive, and control gear is being made. The tank is 400 feet long, 9 feet wide, and 6 feet deep, and provision is made for rapidly suppressing waves. Automatic control of the acceleration and deceleration of the car is being provided. The deceleration control has been applied and operates satisfactorily. The car is driven by endless steel cables from a driving sheave. Some preliminary runs have been made and towing speeds up to 40 feet per second attained.

Engine and Fuel Testing.—The installation of a dynamometer for testing aircraft engines is practically completed. The dynamometer, of the hydraulic type, is capable of testing engines of either tractor or pusher type, air or water cooled, right or left hand rotation, developing up to 1,000 h. p. at speeds up to 1,000 r. p. m.

Equipment for the determination of the knock rating of engine fuels had been installed and a number of samples of aviation fuels tested. Some work had been done on the deterioration of doped fuels in storage.

Chemistry.—Work in chemistry included the following: Utilization of weed seeds screened from the Canadian grain crop; utilization of the bitumen occurring in "tar" sands in western Canada for purposes other than road making; honey fermentation, involving in particular the development of rapid methods of determining the water content of honey by means of the viscosity and refractive index; the development of new products from honey; improvement of maple sugar and the development of new maple products, especially of a new nonmottling and nonhardening sugar, of superflavored sirup and of flavor concentrate; dehydration of apples; laundry methods; tanning liquors; improvements and standardization of testing and grading of asbestos; the utilization of magnesian rock; natural gas; chemical investigation of the physiologically active principles of Canadian plants, particularly poisonous weeds; the lignin component of straw; blasting caps; battery separators; methods for measuring the properties of wool fibres; synthetic plastics and resins; rubber; fish oils; loganberry residues. Work on natural gas has included an investigation of the pyrolysis of methane, ethane, propane, normal butane, isobutane, pentane, etc. Good yields of olefins at low energy consumption have been secured, and new types of apparatus developed. Interesting differences in behavior between straight and branched isomers have been established. Efforts are being made to find a suitable material for the construction of chambers adapted to withstand the temperatures involved without leading to carbon formation. The production of carbon

black by the arc process has been studied to some extent. A study is being made of the physical properties of blown asphalts as influenced by the conditions of blowing. Studies are being made in the technique of rubber testing, particularly the use of molded test pieces. Detail studies are progressing on the stress-strain relations of rubber.

Systematic studies of detergency with special reference to the conditions of practice in power laundries are being made my means of photometric measurements on cotton which has been soiled grey in a standard manner. Methods have been developed for the production of a special basic clinker suitable for furnace linings, magnesia for oxychloride cements and neutral refractory brick of a nonspalling character. The possibility of manufacturing calcium chlorate for use as a weed killer has been explored. A study has been made of the cleaning of corroded bronze statues. Studies in fractionation, especially of petroleum distillates, have been made by means of a column of new design. Considerable testing work has been performed on such materials as explosives, firecrackers, soaps, water for textile uses, soapstone, acid-resisting paints, wash fabrics, laundry builders, textiles damaged in laundering, etc.

Effect of Sulphur Dioxide on Vegetation.—An extensive investigation has been in progress since 1929 of the effect of sulphur dioxide on vegetation. This was undertaken as a result of claims made by residents of the United States against the smelter at Trail, British Columbia, Canada, and referred to the International Joint Commission for settlement. The results of scientific interest, it is expected, will be published when the case is no longer sub judice.

Radio.—Plans are being made by the council to establish a highly accurate primary frequency standard to which all administrative standards in Canada can be referred. It is hoped that a constancy of frequency of at least 1 part in 10,000,000 will be obtained. During the past year a study was made of the generation and transmission of energy at frequencies of the order of 300 megacycles. Circuits were developed and portable transmitters constructed for field use at these ultra-high frequencies. The work was undertaken in connection with the development of radio aids to navigation in Canada and was carried out in the laboratories of the department of national defense. The problem of static interference in radiotelegraph circuits has received considerable attention, and progress has been made toward the elimination of this nuisance from commercial communication systems. The general problem of the nature of atmospherics has also been studied, and equipment is now being installed to enable the Council to investigate the relationship between meteorology and static disturbances that the records of atmospheric discharges might be used in connection with air navigation. A study is under way on the relation between height of the aircraft above ground and the skip distance when using frequencies above 4,000 kilocycles.

Optics.—A beginning has been made in optical research. Some apparatus is already available for spectral and interference work. At the moment attention is being directed to photometric standardization. Plans are being laid for the construction or acquisition of a complete set of apparatus for this purpose. Methods of standard-

izing railway signal lenses in other countries are being studied. On the completion of the requisite apparatus steps will be taken to set up a system of standards for Canada.

Radium.—The council is now prepared to undertake the standardization of radium preparations and the determination of their thorium content. A study is to be made of the instruments used in practical radium therapy to provide the medical profession with facilities for more intelligent estimation of the intensity and localization of gamma ray exposures from radium units.

Heat.—An apparatus has been installed for the measurement of the heat conductivity of building materials. It is of the hot-plate type with the cold side cooled by refrigeration. The effect of moisture on the conductivity of the materials tested is being investigated. Improvements on the thermometer-testing equipment already in use are being undertaken. An investigation of the heat conductivity of refractories is in progress.

Testing Laboratories.—The council during 1931 was equipped to undertake the following: (*a*) The standardization of measures of length; (*b*) the standardization of thermometers, hydrometers, and watches; (*c*) the testing and standardization of aeronautical instruments, including aerial photographic cameras; and (*d*) the testing of telescopes, surveying, and other instruments.

Artificial Lighting Units.—Artificial lighting units have been designed to be used for the inspection, now done by natural light, of wheat and other grains. Two alternative units are being tested by the inspection department of the Board of Grain Commissioners for Canada. The results so far are favorable.

Charging of Films.—The problem of the electrostatic charging of celluloid films used in aerial cameras is being studied. In an attempt to eliminate this, the structure of the camera has been altered. An effort is being made to use radium to discharge the film without causing a spark to mark it. The relative humidity and the state of ionization of the air in the slip stream of flying aircraft has been measured. The results show a definite correlation with the weather conditions during flight.

Ultrasonics.—Several researches have been conducted in ultrasonics. It has been found that a sound wave transmitted longitudinally through liquids contained in tubes is almost totally absorbed at certain frequencies which correspond to the resonant radial vibrations. The wave velocity is also profoundly modified in this region. Somewhat similar phenomena occurring for solid rods are now being investigated.

Electrostatic Voltmeter.—A new type of electrostatic voltmeter for 50 kilovolts and up has been evolved which seems to have advantages over those now in use.

Electric Meters.—Equipment is being provided for research in the development of meters used in the purchase and sale of electric power. An electrical standardization laboratory for the precise standardization of all electrical quantities and calibration of electrical instruments is being planned.

Agriculture.—Pending the completion of the new building the work in agriculture during 1931 was directed from the University of Alberta. The work of the division conducted by its own staff

as distinct from work conducted under its direction in cooperating laboratories consisted of the following researches: Phenolic compounds of the wheat plant in relation to rust resistance, preparation and denaturation of the gluten proteins, gas production and retention in wheat-flour doughs, composition of wheat in relation to stage of maturity and exposure to frost, biological assays of crop residues, and chemicals as herbicides. A weed survey of the Provinces of Alberta, Manitoba, and Saskatchewan has been conducted.

Journal of Research.—In its division of research information the council maintains an information service to deal with scientific and technical inquiries received, both for the benefit of its laboratory staff and other scientific workers in Canada. Technical and economic investigations are carried out and reports prepared on a wide variety of topics. The council publishes an annual report, a series of technical reports and bulletins, and, since 1929, a monthly scientific periodical, the Canadian Journal of Research. There is being built up a large research library, provision having been made in the new building for 300,000 volumes.

ELECTROTECHNICAL LABORATORY

(Tokyo, Japan)

The laboratory is attached to the Ministry of Communications and the director is Dr. K. Takatsu. The work of the laboratory is carried on in five sections—standards and measuring instruments, telephone and telegraph, electrotechnics, radio, and materials. During the fiscal year ending in March, 1931, 21 researches and 10 circulars, besides many private papers, were published by the laboratory.

Standards.—The electrical standards representing the international ohm and ampere legalized by the electrical measurement act enacted in 1910 have been maintained by the laboratory. During the past year the caliber factors of the new tubes were obtained and the preparation for redetermining the international ohm was finished. The researches related to the determination of the ohm in absolute measure are now in progress. According to the resolution of the second advisory committee on electricity, the redetermination of silver equivalent is under way. The international ohm and volt are maintained by a number of manganin resistances and neutral cells, respectively. Hereafter the acid cell, which contains 0.05 *N* acid electrolyte will be added to the group because it has been experimentally ascertained that the cell has good constancy.

In 1929 the primary standard of frequency was established at the laboratory. The standard consists of a Riefler clock, a frequency measuring device, and a 1,000-cycle tuning fork. The frequency of the fork is maintained constant with an accuracy of 1 part in 100,000. Experiments were made on the tuning fork and an electromagnetic system to diminish the damping, and an electrical circuit to minimize the variations of frequency due to change of loading, filament current, and plate voltage.

The photometric standard is maintained by a number of well-seasoned incandescent lamps calibrated by the Pentane lamp. The heterochromatic photometer designed on Pirani-Dziobek's principle has shown a good result on the occasion of the international

comparison of luminous intensity planned by the Bureau of Standards in 1930.

Measuring Instruments.—The laboratory is engaged in the legal verification of electricity meters. In the last fiscal year seven types of integrating meters were approved and 147,087 meters were tested. Besides those, 364,283 meters were tested by three laboratories approved by the ministry. Much work has been done on the analytical study of the performance of the induction watt-hour meter. In connection with the testing of instrument transformers, the phase angle of a shielded resistor for 30 kilovolts has been determined and the time constant of noninductive low resistance has been found. There were 1,171 tests requested of various measuring apparatus, such as voltmeters, ammeters, wattmeters, resistances, inductances, condensers, etc.

Telephone and Telegraph.—All telephone and telegraph apparatus used by the ministry are tested by the laboratory. In the last fiscal year there were 6,332 requests for tests, namely: Telephone apparatus and switchboards, 4,885; telegraph apparatus, 1,228; and accessories, 219. Almost all the apparatus were supplied by home manufacturers. Work has been done on the improvement of such apparatus, and automatic devices for life test of telephone apparatus have been provided.

Many investigations have been made relating to the audio-frequency current bridge, especially the no-loss condenser and earthing device. The articulation efficiency for transmitter and receiver is investigated from the acoustical and mechanical standpoints. The characteristic frequency bands of the Japanese vowels have been obtained and the composition of Japanese language has been statistically investigated in order to establish a perfect method of testing articulation in telephone systems.

Electrotechnics.—The standardization activities relating to electrotechnics have been made in cooperation with the Japanese electrotechnical committee. Many investigations relating to the rating of electrical machinery, the rupturing capacity of oil circuit breakers, the current-carrying capacity of cable, and the standardization of lightning arresters have been made. The equivalent d. c. value in the breakdown test of cable with a. c. has been determined and the life tests on heater elements and incandescent lamps have been continued.

Researches on lightning, induction of power line, synchronous and asynchronous machines with secondary excitation, mercury inverter, electro-osmosis, and technical applications of grid-glow tube were carried on. The noises of electrical machines have been analyzed acoustically and the relation between the noise character and the construction of machine has been found.

Radio.—Since 1924 a systematic research on wave propagation has been continued. To begin with, field-intensity measurements on long-distance stations emitting low-frequency waves were conducted. The directional observations and polarization measurements were made on near-by low-frequency stations, while similar observations were conducted on broadcast stations in the Pacific area. At present, high-frequency wave measurements are in progress in several lines. With the results thus obtained theoretical studies are made. A new

theory on the propagation of low-frequency waves has been advanced and a portable type of high-frequency wave direction-finder was developed.

The precise measurement of radio-frequency employing a multitable type of high-frequency wave direction finder was developed, and many commercial wave meters were calibrated by this device.

Extensively scientific and technical researches are being carried out on piezo-electric quartz crystal. From the above experience the design and manufacture of quartz plate holders may be made satisfactorily over the whole range of radio frequency in accordance with the requirement of C. C. I. R. All the quartz plate holders used by the ministry are supplied from the laboratory and the frequency of quartz plates to be used in all the commercial stations in the country are calibrated by the laboratory.

Researches on radio transmitters, receivers, and electron tubes are also conducted. Among those, elimination of harmonies and frequency stabilization of radio transmitters which has remained an unsolved problem since the first C. C. I. R. meeting at The Hague are included. The problems brought up in the second meeting at Copenhagen are now being studied. The laboratory also assists the activities of the national committee of U. R. S. I.

Materials.—During the past year a number of tests requested have been carried out on telephone cable, insulators, storage batteries, dry cells, etc.

A new magnetic material similar to permalloy which has large initial permeability and high resistivity has been discovered. The process of producing copper oxide, which will be more available as a dry rectifier, has been developed. The mechanism of oxidation of mineral oil was studied and the resarch toward a powerful antioxidant is being followed. Researches on acetyle cellulose, fused basalt, artificial resins, polymerized rubber, and porcelain insulators have been continued.

TOKYO INDUSTRIAL RESEARCH INSTITUTE

(Tokyo, Japan)

The Tokyo Industrial Institute was established in 1900, and is under the control of the Minister of Commerce and Industry of the Japanese Government. Its director is Dr. Fusajiro Kodera. Its staff of research workers and assistant investigators numbers over 100. To promote the progress of Japanese industries the institute is solving various important chemical industrial and technological problems, and deals with the analysis, testing, and examination of materials. The institute is engaged in standardization activities in cooperation with several organizations, such as the Association of Portland Cement, the Society of Chemical Industry, etc., and the Bureau of Rationalization of Industry of the Department of Commerce and Industry.

The main part of the institute is located at Yoyohata, near Tokyo. One branch of its work is located at Meguro, near Tokyo.

In addition to its administrative staff, the institute is divided into six scientific and technical divisions, as follows: (1) General analyses, examinations; (2) consultations pertaining to fats, waxes, oils, soaps, petroleums, chemicals, paints, lacquers, papers, rayon, saccharides,

protein, etc.; (3) work relating to examinations and consultations pertaining to cements, porcelains refractory materials, Seger cones, saggars, etc.; (4) analyses, examinations, and consultations pertaining to coal tar, dyestuffs, mordants, etc.; (5) examinations and tests in the field of electrochemistry, electrometallurgy, high-voltage electricity, the testing of porcelain, cement, iron, and several other materials; (6) investigations pertaining to synthetic chemistry at high pressure.

When an experimental research is completed in the research laboratory, it is examined on a semiindustrial scale with a view to the further development and improvement of methods and materials for industrial use.

Laboratory space is made available to the general public for experimental work where research workers, for a nominal fee, are supplied with a definite amount of chemical reagents and experimental equipment, are permitted to utilize the library of the institute, and its precise measuring instruments. The regular staff is available on request to give aid through consultation.

A schedule of fees is published covering the analysis or examination of materials and consultation.

The results of the investigations and researches conducted by the institute are published in a pamphlet entitled Tokyo Kogyo Shinkenjo Hohoku, or in well-known journals in Japan. Several hundred technological papers have been issued to date.

The institute participates in the work of the Japanese Engineering Standards Committee, and in cooperation with that body the following specifications in the number indicated were completed during the past six months: Petroleum products, 19; pigments, 7; analyses of commercial metals, 3. In addition, the laboratory conducts a great variety of tests to prove whether or not the items submitted to the committee comply with specifications.

IV. NATIONAL INDUSTRIAL STANDARDIZING BODIES

National standardization in industry was first begun on an organized basis in 1901, when there was established in Great Britain a national committee to formulate standards for engineering materials. Other countries did not at once follow this example, so that it was not until 1916 that a second such committee was organized, in the Netherlands. During and following the World War, as its value as a factor in promoting a country's economic welfare became more generally realized, national standardization spread rapidly, until to-day the work is under way on six continents.

The following 21 countries now possess national industrial standardizing bodies, organized in the years indicated: Great Britain, 1901 (reorganized in 1931); Netherlands, 1916; Germany, 1917; United States of America, 1918 (reorganized in 1928); Switzerland, 1918; France, 1918 (reorganized in 1928); Belgium, 1919; Canada, 1919; Austria, 1920; Italy, 1921 (reorganized in 1930); Japan, 1921; Hungary, 1921; Australia, 1922 (reorganized in 1929); Sweden, 1922; Czechoslovakia, 1922; Norway, 1923; Poland, 1924; Finland, 1924; Russia, 1925; Denmark, 1926; and Rumania, 1928.

In addition to those countries in which recognized national standardizing bodies are in operation, standardization is being carried on or has been proposed, on a more or less national basis, in China, Dutch East Indies, Greece, Haiti, India, Iraq, Latvia, Madagascar, New Zealand, Philippine Islands, South Africa, and certain South American countries.

In general, the various national bodies promote "standardization within standardization," functioning in a rôle of centralization, coordination, and liaison. They study standardization from a technical and commercial point of view in every domain of industry, afford an adequate organization and a more ample development for existing standardizing activities, and establish generally recognized standards of various kinds. Industry is represented in its relations at home and abroad. The latest foreign developments are applied, when helpful to domestic uses. In short, the national standardizing bodies further the standardization movement in every practicable way as a means of advancing national economy.

There are given below brief outlines of the activities and accomplishments of the national industrial standardizing committees or associations in 20 of the countries in which such bodies exist. A review of the work of the American Standards Association will be found in Chapter VIII (p. 281). The sketches are based chiefly on information supplied by the various countries to the American Standards Association and on material furnished by the foreign offices of the United States Bureau of Foreign and Domestic Commerce.

An organization commonly known as the International Federation of Standardizing Associations (ISA), formed to serve as a

connecting link between most of the national bodies dealt with in this section, is treated in Chapter II (p. 91).

AUSTRALIA

Standards Association of Australia (SAA), W. R. Hebblewhite, general secretary, Science House, Gloucester and Essex Streets, Sydney, New South Wales, Australia.

The Standards Association of Australia, established in 1929 under the patronage of the Commonwealth and State Governments for the promotion of standardization and simplified practice, is the body officially recognized as the authority for promulgating Australian national standards. While the organization has complete autonomy, a liaison with the Commonwealth Government is effected through the Council for Scientific and Industrial Research.

Control of the association is vested in a council representative of the Commonwealth and State Governments; the Institution of Engineers, Australia; Australasian Institute of Mining and Metallurgy; Australian Chemical Institute; Royal Australian Institute of Architects; Federated Master Builders' Association; Australian and New Zealand Railways Conference; Associated Chambers of Manufactures of Australia; Associated Chambers of Commerce of the Commonwealth of Australia; Bureau of Steel Manufacturers of Australia; the Federal and State purchasing departments; and the Postmaster General's department.

Technical work is conducted by divisions on standardization and simplified practice, and by a special Power Survey Committee. The standards division directs the activity of 36 sectional committees, which, with more than 300 subcommittees and panels, have a personnel of over 2,600.

Under the auspices of the standards division, standard specifications are being prepared or have been recently prepared by sectional or special committees on bore casings, building materials, calcium carbide, cement, coal and coke, colliery equipment, electrotechnics, fire bricks, locomotives, machine belting, machine parts, nonferrous metals, pipes and plumbing, road-making materials, structural steel, timber, tramway rails and fishplates, and typography.

A committee on ferrous metals is engaged in reviewing and coordinating the work of those committees mentioned above which deal with items of ferrous metal.

Other committees are preparing codes for concrete and reinforced-concrete structures, cranes and hoists, lift installations, pump tests, refrigeration, and steel-frame structures. The committees on boiler regulations and electrical-wiring rules have completed their assignments.

The production of the boiler code and wiring rules is the culmination of some years of consistent effort on the part of the responsible committees. Both publications are already in considerable demand, and promise to be of exceptional usefulness.

The simplified-practice division has published the recently accepted recommendations on plywood panels for stock doors, and a classification of building materials and equipment.

Negotiations are rapidly approaching completion on proposed recommendations for sheet-metal fittings for building exteriors, road-gully gratings, laminated-steel springs for motor cars, shovel sizes, fibrous-plaster sheets for interior walls, and commercial and technical paper sizes. Work is going forward on the development of recommendations for bank checks and drafts, materials, equipment, and supplies for public institutions, and general contract conditions.

The Power Survey Committee has completed the first section of its program, namely, the issue of reports on the available power resources of the Commonwealth. The second section of the work, which will be begun at some time in the future, deals with the analysis of these reports and the formulation of a national policy for the utilization of the resources.

In its capacity of the Australian National Committee of the World Power Conference, the Power Survey Committee has had referred to it such matters as the drafting of forms for recording statistics, on a comparative basis, for coal, lignites, petroleum, natural gas, oil, and supply of electrical energy; power bibliography bulletins; water rights and licenses; and the International Commission on Large Dams.

The Electrical Section Committee, in addition to carrying on its function as a specification-drafting unit, has actively maintained its work as the Australian Electrotechnical Committee of the I. E. C. A wide range of subjects has received attention under the following main headings: Vocabulary and nomenclature, symbols, voltages and currents, rating of electrical machinery, internal-combustion engines, steam turbines, rating of rivers, high-voltage insulators, electric-traction equipment; transformers, overhead lines, oil switches and circuit breakers, terminal markings, aluminum, lamp caps and holders, insulating oils, tolerances, methods of testing lac for electrical insulating purposes, measuring instruments, radiocommunication, laws and regulations dealing with electricity, overlapping of international electrical organizations, Faraday centenary celebrations, 1931, and the International Electrical Congress, 1932.

In response to a request from electrical manufacturers, the association has convened conferences to consider in what way it could bring about the establishment of a routine system in the various States for testing commercial electrical equipment by recognized testing laboratories at a moderate charge.

The association has maintained a close contact with standardization and simplification activities of the various national standards associations, by the exchange of publications and reports and the circulation of inquiries for information on specific projects.

During the year 1930–31, 62 new Australian standards and 1 miscellaneous publication were issued. Of the former, 32 are tentative standards indorsed as standard specifications (electrical requirements (9), railway rolling-stock materials (4), paint and varnish products (18), and water-supply fittings (1)); 25 are new standard specifications (electrical requirements (2), nonferrous metals (2), materials for boilers (18), and water-supply and sanitary fittings (3)); one is a revised standard specification (structural steel); two are codes; and two are simplified-practice recommendations. The total number of

standards in force on June 30, 1931, was 159. In addition, five general and power survey reports have been issued.

The association is taking steps to have registered a brand or trademark which may be used by manufacturers to indicate that goods on which such a mark appears comply with the requirements and tests of Australian national standards.

The various States of the Commonwealth have been requested, and have signified their willingness, to arrange for the insertion in all departmental tender forms of a clause to the effect that all materials, unless otherwise specified, shall be in accordance with Australian standard specifications where such exist or, in their absence, with British standard specifications.

The foregoing and other matters initiated by the association were incorporated into a set of recommendations drawn up by a special subcommittee on standardization at the British Imperial Conference in 1930. These recommendations, which received the approval of the conference, were designed to develop and coordinate the British and Dominion standardizing movements on an Empire basis, and in addition to those mentioned, were concerned with the following topics:

The establishment of uniform reference standards in each Dominion for all units of measurement in common use throughout the Empire and provision for periodical comparison with the corresponding standards at the British Board of Trade or at the National Physical Laboratory, in England.

Importance of standardization to the economic welfare of the Empire, the need for centralization of all such activities under one control in each part of the Empire, and the claims of such activities upon the respective governments for financial and technical assistance.

The advantages of coordination of the efforts of standardizing bodies in the various parts of the British Commonwealth of Nations, with a view to establishing uniform standard specifications so far as is practicable in their common interest.

Extension of spheres of activity to include codes or rules in addition to specifications for materials.

The development of industrial simplification as a preliminary to standardization in suitable cases, and for the promotion of economy in production and distribution.

The value of surveys to ascertain the degree of adherence accorded to standards, and the need for special measures to secure their adoption.

The appointment of a specific department of Government charged with the duty of watching and stimulating the movement towards standardization and simplification.

AUSTRIA

Österreichischer Normenausschuss für Industrie und Gewerbe (ÖNIG), Dr. Jaro Tomaides, secretary, Vienna III, Lothringerstrasse 12, Austria.

The Austrian Standards Committee, established in 1920 on the initiative of the National Society for Austrian Industry and the

Austrian Union of German Engineers, functions as the central Austrian standards-making body.

The ÖNIG, whose 800 members are representative of various Austrian associations and professional societies, is directed by a main committee of 18 members, which has for its chief function the control of the relationships of each technical committee with other committees having fields of work which may overlap, or have other interrelationships requiring coordination or provision for intercommittee conferences.

The work of preparing standards is carried on by technical committees, whose membership, for the facilitation of work, is generally limited to 8 to 10 persons. A draft is developed by a working committee of 3 or 4 men.

Draft standards are published for a period varying from two months to a year, for public examination and criticism. After any necessary corrections have been made, standards are sent before an editorial committee to be criticized for form and style, as well as for agreement with other standards. Each different standard submitted has its own editorial committee, the chairman of which meets with the technical committee which prepared the standard. This chairman is a permanent officer who is in charge of all of the various editorial committees.

The final approval of standards is a function of the main committee.

The present status of Austrian standardization is summarized in the following table.

Industrial groups	Completed standards	Published for criticism	Work under way	Total
A. General standards	7	10	27	44
B. Building	67	44	11	122
BH. Mining and smelting	42		17	59
C. Chemical industry	18	21	5	44
E. Electrical engineering	55	11	37	103
F. Fire fighting		1	6	7
K. Hospitals	6	2	1	9
L. Agriculture		2	8	10
M. Mechanical engineering	358	28	33	419
V. Traffic	34	8	8	50
Total	587	127	153	867

One of the most important projects carried out by the ÖNIG relates to general specifications for petroleum oils, applying to steam, gas, oil engines, and refrigerating machinery. These specifications were completed after two years of technical work.

Another subject of study is hospital standardization, with special reference to appliances used by the patient—equipment, including beds, cabinets, and tables, and surgical instruments. Such work is similar to that now being carried on in Germany.

Standardization is being conducted in the field of mining on such items as mine cars, crown drills, compressed-air-motor connections, ventilating-air pipes, splice plates, track gages, tools, including drills, picks, axes, and mine carpenters' adzes, hammer and shovel handles, and eyes for insertion of the handles of common tools.

Austrian standardization lays particular emphasis on simplification. By standardizing the height of nuts at eight-tenths diameter, substantial savings have been effected by industry. Eighty per cent of all roofing paper produced is made in 4 thicknesses, instead of 11 as formerly. Lumber, formerly manufactured in 35 widths and 24 thicknesses, is now produced in 25 widths and 14 thicknesses. One type of mine car now replaces the 32 once used for carrying coal, ore, and salt. Sixteen mine track gages have been reduced to four.

BELGIUM

Association Belge de Standardisation (ABS), Gustave L. Gérard, general secretary, Max Reichert, secretary, 33 rue Ducale, Brussels, Belgium.

The activities of the Belgian Standards Association have been concentrated on a limited number of studies, with the result that since the last report the work in hand has progressed considerably.

During 1930 the association published a report on standard sections and two reports on specifications for cements. In addition, reports on electric incandescent lamps and insulated wires and cables were issued by the Belgian Electrotechnical Committee, an independent organization whose work is published under the patronage of the Association Belge de Standardisation.

In 1931 there were completed the specifications for direct-current tram and railway motors, together with a reissue of the specifications for the purchase of electric machines and transformers.

The association has submitted for general comment and criticism its standardization projects on chemical analysis of oils, analysis of lubricating greases, pipe systems, and cast-iron flanged valves of the water and gas types.

The annual report as of July, 1931, shows the completion of 48 standards, with work progressing on 16 other projects. These standards and projects may be classified according to industrial groups as shown in the table.

Industrial groups	Standardization projects	
	Complete	Incomplete
A. Civil engineering	9	0
B. Mechanical engineering	20	8
C. Electrical engineering (Belgian Electrotechnical Committee)	17	0
H. Metallurgy	1	1
K. Chemical industry	0	2
M. Mining	0	2
P. Paper industry	1	0
Z. Miscellaneous	0	3
Total	48	16

CANADA

Canadian Engineering Standards Association (CESA), B. Stuart McKenzie, M. E. I. C., secretary, 46 Elgin Street, Ottawa, Canada.

Thirty-two standards have been completed by the association, while work is going forward on 28 other standardization projects, as shown in table.

Industrial groups	Standardization projects	
	Total	Complete
A. Civil engineering	18	7
B. Mechanical engineering	14	4
C. Electrical engineering	15	10
D. Automotive work	3	2
E. Railway work	1	1
G. Ferrous metallurgy	8	8
M. Mining machinery	1	0
Total	60	32

The CESA is extending its operations more and more into the field of simplified practice. Its standards include not only quality specifications for materials and safety codes, but also recommendations limiting the types and sizes of certain manufactures to those having the greatest commercial demand.

The association has recently published revised editions of the existing standards on steel structures for buildings, stove bolts, billet-steel reinforcing bars, rail-steel reinforcing bars, and steel wire for concrete reinforcement. In addition, there has been issued a revision of Part I of the Canadian Electrical Code, as well as a French translation of this document. This code has now been adopted by all the Canadian Provinces except Manitoba and Prince Edward Island.

Twelve additional standards, which were to have been published during 1931, cover the subjects of cap screws, set screws, and studs; machine, carriage, and plow bolts; binder screws, machine screw nuts; blade punching for road-grading machinery; color scheme for identification of piping systems; wood piling and pile driving; power transformers; cedar poles; transformer and switch oil; lead-covered power cable; and power-operated radio receiving devices.

Other subjects on which work is going forward include bituminous, broken stone, concrete, earth, gravel, and sand-clay roads, block pavements, foundations and subgrades, road structure, highway terms, building brick, cast-iron pipe, sheet-metal gages, gearing, fire-hose connections, electrical machinery, highway-traffic signals, and mining-drill chucks and steel. Part III of the Canadian Electrical Code, on outside wiring rules, is also being completed.

CZECHOSLOVAKIA

Československá Normalisační Společnost (ČSN), F. Juliš, manager, Dům čs. inženýrů, Prague I, Czechoslovakia.

The ČSN, established in December, 1922, is a commercial association of industrial organizations which have signed the deed of agreement engaging them to supply the necessary funds for standardization by annual contributions, the amount of which depends on the number of workers employed. In 1931 there were about 110 associated firms, employing more than 200,000 workers.

The association is managed by a main committee, consisting of 14 members elected by industry at the plenary meeting and 5 members nominated by the Government, with an equal number of alternates for either group.

The essential part of the standardizing work is performed by the technical committees and subcommittees of the ČSN, which consists of delegates of interested industrial and commercial organizations and authorities. In 1931, 160 committees and subcommittees were at work on the standardization of engineering, metallurgy, and the building, chemical sugar, leather, color, textile, glass, and other industries. Completed standards are published in Czech and German in the form of booklets, each of which embraces a whole field, although in certain special lines, such as locomotives, automobiles, and aircraft, standards are issued on leaflets. Up to July, 1931, there have been issued 65 ČSN standards in the form of booklets, representing more than 2,000 leaflets, besides 36 leaflets relative to locomotive building and 28 relating to automobile construction. The technical committees are at present preparing more than 100 other standards in the form of booklets and about 150 standards leaflets.

Completed standards cover the following subjects: Paper sizes; color shades of enamel; printed forms for sugar factories; mechanical drawings; limits and fits; threads; screw bolts and nuts; washers; wrench openings; rivets; keys and springs; cotter pins; hand wheels and grips; machine-tool couplings; open link chains; flat link chains; ball and roller bearings; transmissions; tanned leather belting; field-railway truck wheels; steel rails for narrow gage railways; steel sections, angle irons, tees and zees; copper, brass, and aluminum sections, plates, and wire; terminology of iron and steel; rolled and forged carbon steel; nonferrous metals (copper, brass, aluminum, nickel); soft and hard solders; steel castings; grey-iron castings; testing of steel; steel wire and wire nails; boiler plates; steam turbines; water turbines; water power; cooling plants and refrigerants; central heating and ventilating systems; elevators; pipe systems; steel pipe; cast-iron pipe for gas and water conduits; flanges; pipe fittings; screwed pipe couplings for beer retailing plants; maximum loads and stresses in structures; rules for steel structures; timber structures; rules for carpentry; rules for locksmiths' work; rules for roofing work; door and window hinges; wooden office furniture; wall tiles; flooring tiles; parquet flooring; xylolith flooring; paving stone; clay sewer pipe; sampling of coal; various locomotive and automobile parts.

Electrotechnical standards are not comprised in the above enumeration, the electrical section of standardization being managed autonomously by the Electrotechnický Svaz čs. (ESČ), or Czechoslovakian Electrotechnical Association, which prepares its own standards, submitting them to the ČSN for approval. In 1931 about 145 technical committees and subcommittees of the ESČ were engaged in standardization work. Up to July, 1931, there had been issued 35 ČSN-ESČ standards in the form of booklets, besides 5 comprehensive publications containing standard rules for electrical work. The ESČ has also published, in cooperation with the ČSN,

an abridged edition of the Decimal Classification, with complete electrotechnics, for the use of technical engineers. About 35 standards are being prepared by various technical committees of the ESČ.

The ČSN is cooperating also with the Masaryk Academy of Industry, with the Czechoslovakian Ceramic Society, with the Czechoslovakian Association for Testing Materials, and other bodies which are submitting their drafts to the ČSN for approval, the central authority of the latter as regards standardization in Czechoslovakia being generally recognized.

The ČSN publishes its own monthly bulletins, "Zprávy ČSN" (in Czech), and "Berichte der ČSN" (in German), containing proposed standards submitted for public criticism and various information relative to standardization both in Czechoslovakia and abroad.

For the purpose of popularizing the idea of standardization with the general public, a comprehensive exhibition of standardization was made by the ČSN in the spring of 1931, in the Prague Fair Palace. This exhibit was attended by about 10,000 visitors.

DENMARK

Dansk Standardiseringsraad (DS), H. E. Glahn, secretary, Industribygningen, Copenhagen V, Denmark.

Although the 24 members of the Danish Standards Council are appointed by the Ministry for Industry, the association is representative not only of governmental departments, but also of all technical, industrial, and trade organizations which are interested in standardization. Its expenses are equally divided between the Government and private interests.

The council's work is organized by a business committee, which is empowered to make decisions on behalf of the parent body, except as regards such questions as the acceptance of standards, membership in the council, and decisions concerning its regulations, yearly budget, and schedule. Among other duties, the business committee secures standardization data from domestic and foreign sources, and contacts the national standardizing bodies of other countries.

The preparation of standards is carried on by 20 technical committees, whose membership, including that of 27 subcommittees, numbers 204 persons. Work is going forward on oils for technical purposes; tiles; heights of axes; shaft-ends and flange couplings; spoons, forks, and knives for hospitals; doors, windows, and hinges; threads, bolts, and nuts; general technical standards; drawing standards; paper sizes; Edison threads; fire-hose couplings; gas cocks; agricultural machinery; lettering of drawings; textiles for hospitals; steel and iron; land rollers; stamp of origin and property in a drawing; marks of correction; and water cocks.

Completed standardization projects are first submitted to the business committee, which has for its duty to determine the origin of the standard, to what extent it influences other stands, and if it has been properly published for general comment and criticism; to make a summary of groups and associations (consumers and producers) who are in a position to give opinions on proposals; to report the degree to which investigation has been made concerning agreement

between the proposed standard and similar foreign standards, and to report on the different opinions presented in case a decision has not been unanimously agreed upon.

On leaving the hands of the business committee, projects are brought before the council for ratification as Danish standards. In case it is not possible to obtain a standard that will meet the requirements, a project may be accepted as a temporary standard with the intention of later adopting it as a permanent standard when experience shall have suggested suitable modifications.

At its 3 meetings in 1930, the council adopted 30 proposals as Danish standards and 1 proposal as a temporary Danish standard. The report as of July 1, 1931, shows a total of 93 accepted standards, with 122 projects still in progress. These standards and projects may be classified as shown in the table.

Industrial groups	Standardization projects	
	Completed	Under way
A. General	63	42
B. Mechanical engineering	19	15
C. Electrical engineering	0	2
G. Civil engineering	6	1
H. Ferrous metallurgy	0	49
L. Textile industry	0	4
N. Agriculture	0	3
P. Paper industry	0	1
Z. Miscellaneous	5	3
Total	93	122

The council publishes a list of Danish firms which have agreed to manufacture certain or all of their products in accordance with Danish standards. To indicate such compliance with standards, these firms are permitted, without charge, to label their goods with the council's registered trade-mark, "DS." Penalties are attached to the misuse of the symbol.

FINLAND

Finlands Standardiseringskommission (SFS), A. Willberg, secretary, Mikaelsgatan 19, Helsingfors, Finland.

The Finnish Standards Committee, established in 1924, is composed of representatives of governmental departments, railroads, and national technical societies, trade associations, and educational institutions. About half of its expenses are defrayed by the Government and the remainder by interested private organizations.

The work of the committee is focused on the subjects of mechanical engineering, electrical engineering, the paper trade, fire-fighting technology, packing, and graphics. It is carried out partly by the standards office and partly by committees which are appointed by the central organization. An exception is the committee for standardizing agricultural machinery, which was appointed by the Central Union of Agricultural Producers in Finland.

The report for October 15, 1931, lists 242 standards which have received official approval and have become generally recognized throughout Finland. Five hundred projects are under way. The table classifies the standards and projects according to industrial groups.

Industrial groups	Standards	Projects
A. General standards	0	25
B. Mechanical engineering	202	250
C. Electrical engineering	1	100
H. Raw materials	0	50
K. Chemistry	0	5
N. Agriculture	0	20
P. Paper	9	20
Z. Miscellaneous	30	30
Total	242	500

Under the subject of mechanical engineering, standards for machine parts, among which screws, nuts, rivets, and wedges have been completed, form the largest category. Among transmission standards, bearings and accessories have received most attention. Only the main dimensions of piping have been standardized, but other factors are being considered. Woodworking and agricultural machinery are still in a preparatory stage. Except in isolated cases, where the work was extended to include specifications for quality and workmanship, chief attention has been paid in working out these standards to size simplification.

The only electrical standard completed to date is a comprehensive publication relating to a safety code for electric plants. In the paper trade, standards have been completed for dimensions of paper, including letter paper, envelopes, and forms, while projects are under way on quality specifications and test methods.

In the field of fire fighting, standards for fire hose and couplings are almost completed. Preliminary work has been done on the standardization of hand and motor fire engines, and in drafting rules for fire-extinguishing chemicals.

FRANCE

Association Française de Normalisation (AFNOR), R. Girardeau, director general, 27 Avenue de Friedland, Paris, France.

The French Standards Association is a private organization financed largely by industry, which centralizes French standardizing activities, represents them internationally, and acts as a liaison between industry and the Higher Committee on Standardization, a Government organization which controls French standardization through general instructions transmitted to the AFNOR and which has the authority to give final aproval to completed standards.

The technical work of standardization projects is carried on by standardization associations or by competent committees appointed by the AFNOR. Three such general commissions were recently added to the 14 already functioning, so that work is at present going forward on building materials, boiler plates, carpets, wool blankets,

and other materials, drawn wire products, preserve cans, fluid meters, simplification of hand tools, naval construction, siderurigical products, sections, rails, nonferrous metals, paper, coal, and test pressures.

Standardization projects are given the greatest possible publicity, being sent to technical journals, chambers of commerce, Government departments, and all interested associations, corporations, and firms.

The progress of work as of July 1, 1931, is summarized in the following table:

	Completed standards	Projects	Revisions	Total
A. Metallurgical products	5	4	11	20
B. Construction materials	5	0	6	11
C. Electrical industry	16	15	1	32
E. Machine elements	10	0	2	12
Committee on Standardization of Mechanics	94	22	1	117
F. Metallurgy and metallic construction	2	0	3	5
G. Textile industry	0	4	0	4
H. Thermal machines and hydraulics	0	1	0	1
J. Naval construction	0	5	14	19
K. Mining industry	0	1	0	1
L. Cycles and automobiles (Bureau of Automobile Standardization)	95	17	5	117
M. Units of measure and tolerances	0	1	0	1
O. Aeronautics (Bureau of Standardization of the Air Ministry)	0	67	0	67
P. Construction	0	0	1	1
Q. Paper	0	1	0	1
R. Containers and packing methods	0	6	0	6
S. Tools	0	7	0	7
X. Rational numbers	1	0	0	1
Total	228	151	44	423

GERMANY

Deutscher Normenausschuss (DNA), Dr. Engineer Hellmich, managing director, Berlin NW. 7, Dorotheenstrasse 47, Germany.

German standardization is controlled by the Deutscher Normenausschuss (German Standards Committee), a body functioning without fixed rules or procedure, constitutional limitations, or formal by-laws.

The DNA is governed by an executive commiteee, in which are represented the various circles interested in standardization. Business work is handled by a large staff, including many engineers.

The preparation of standards is carried on under the supervision of the DNA by affiliated organizations or special industry committees, in which are represented producers, distributors, consumers, the Government, and science. Draft standards are given wide publicity in the technical press, and criticism thus evoked is taken into consideration.

After any necessary revisions, the drafts are edited by a special committee, printed in proof form, and submitted to the executive committee. If approved by this body, they are then published in final form, bearing the symbol, "DIN," to indicate acceptance as standards.

The standards are divided into two classes, "Dinormen" and "Fachnormen." The "Dinormen" include standards covering more than one industry, or the industrial field as a whole. "Fachnormen" are standards for subjects within particular branches of industry.

More than 3,400 standards have been completed up to the present time, while over 1,000 projects have been published for criticism, and further proposals are in preparation. In addition, 1,200 standards have been prepared by the Merchant Marine Standards Committeee (HNA).

The following tables summarize the present status of work. In Table 2 the symbol appearing after each item indicates the organization responsible for preparing standards in that particular industrial group.

TABLE 1.—*"Dinormen"*

Classification	Number of standards		Classification	Number of standards	
	Total	Completed		Total	Completed
Bottles	4	4	Office and drafting equipment	3	-------
Building industry	439	365	Photography	9	5
Burial practice	1	1	Piano construction	5	2
Construction materials	102	76	Pipes and tubes	245	130
Dispatching means	1	1	Railroads	55	30
Fittings (valves, pressure gauges)	108	71	Sewing machines	8	6
Foundry practice	8	3	Shoe manufacture	8	8
Furniture	5	4	Steam boilers	4	3
Gas masks	3	-------	Street railway practice	55	29
Gas-welding industry	9	9	Tools	288	221
General fundamental standards and technical fundamental standards	326	300	Transmission	24	24
Heating	4	4	Typewriters	31	28
Hoisting machinery	19	18	Underground construction	4	0
Housekeeping	74	72	Water turbines	5	5
Library practice	6	5	Weighing and testing machines	6	1
Load and acceptance testing	1	1	Welding practice	5	5
Machine tools	49	34	Total	2,250	1,771
Mechanical engineering	336	306			

TABLE 2.—*"Fachnormen"*

Classification	Number of standards		Classification	Number of standards	
	Total	Completed		Total	Completed
Agriculture (LAND)	83	33	Motion-picture industry (KIN)	7	7
Air travel (L)	53	47	National Committee on Specifications (RAL)	5	5
Automotive industry (Kr)	232	208	Printing trade (NAGRA)	6	6
Bicycle building (FAFA)	39	38	Railway cars (WAN)	110	75
Chemical apparatus (DENOG)	88	75	Shipbuilding (HNA)	1,300	1,200
Electrical engineering (VDE)	410	350	Surveying practice (VERM)	13	-------
Fire fighting (FEN)	44	19	Textile industry (TEX)	112	70
Hospital practice (FANOK)	96	45	Woodworking machinery (VDH)	10	10
Locomotive construction (LON)	537	439	X-ray practice (RÖNT)	3	3
Material testing (DVM)	54	20			
Meat-cutting machines (VDF)	10	10			
Mining (BERG)	297	187	Total	3,509	2,847

GREAT BRITAIN

British Standards Institution, C. le Maistre, C. B. E., director and secretary, 28, Victoria Street, London, SW. 1, England.

As a result of the resolutions on standardization presented at the last Imperial Conference held in London, the former British Engineering Standards Association has been reorganized and has

been renamed the British Standards Institution. In order to represent more completely the industries concerned, the organization, originally formed for the purpose of conducting standardizing activities in the engineering field only, has broadened its functions to include the four divisions of engineering, chemistry, building, and textiles. It is hoped that through the new arrangement greater cooperation may be maintained with the Dominion standardizing bodies and standardization carried out to a greater extent than was possible before.

Each of the four new divisions operates under its own council, but all are under the control of a central authority.

The Standards Institution has recently promulgated new or revised British standards for the attachment of circular metal-cutting saws for cold working; short-link wrought-iron crane chain; wrought light aluminum-alloy sheets, strips, and tubes; steel pipe flanges; tar for road purposes; air-screw hubs; engine flange fixings for air-screw hubs; steel gas cylinders; valve fittings for compressed gas cylinders; identification colors for gas cylinders; naval brass plates, sheets, and strips; test sieves; indicator cock connections and diagram sheets; steel tub wheels and axles for use in mines; wood saws; Y alloy, sheet and strip; brazing solder; paint colors; magnet testing; porcelain insulators; motor-car wheel rims; electrical insulation; sampling and analysis of coal; and tungsten lamps.

Although Great Britain has advanced in boiler design, until recently nothing had been accomplished on the standardization of boilers. As the result of a conference convened by the standards association, at which were represented the boilermakers, insurance companies, statutory authorities, and others concerned, a committee has been appointed to work out a general scheme of rules regarding boiler design and construction and other cognate matters.

HUNGARY

Magyar Ipari Szabványositó Bizottság (MISz), Ed. Gellért, secretary, Reáltanoda utca 13–15, Budapest IV, Hungary.

Although attempts to organize a central standardizing agency in Hungary were first made in 1918, it was not until 1921 that the constitution of such an organization could be prepared and approved and the Hungarian Engineering Standards Committee established as an independent autonomous body.

The plan of organization of the MISz calls for a main committee, an executive committee, sectional committees, a council, and a business staff. The main committee, made up of representatives of industrial and engineering corporations and societies, government departments and boards, and engineering and technical schools, numbers among its duties the supervision of the country's standardizing activities and regulation of financial matters. The executive committee, consisting of four members elected by the main committee, handles the appointment of members to the technical sectional committees and provides for the publication of standards.

Standardization proposals are drawn up by the sectional committees, of which 13 are at present at work on the subjects of engineering

drawing practice, machine parts, tolerances, building materials, piping, house-heating equipment, coal and bituminous materials, ferrous metallurgy, paper industry, and lubricating oils. Also, 12 special committees are developing standard forms of building contracts.

The approval of standards is a function of the council, which is composed of the members of the executive committee and especially qualified individuals appointed by the Minister of Commerce.

Approved standards are reviewed at least once each year for the purpose of making any necessary revisions.

According to the progress report for July 1, 1930, 14 standards had been adopted and put into practice, while 78 projects were under way. No information is available concerning accomplishments for the fiscal year 1930–31.

ITALY

Ente Nazionale per l'Unificazione nell'Industria (UNI), I. Locatelli, general secretary, Foro Bonaparte 16, Milano, Italy.

Established in 1930 under the auspices of the General Fascist Confederation of Italian Industry, the National Association for Industrial Standardization represents an outgrowth of its predecessor, the Committee for Standardization in the Mechanical Industry, with expanded objectives. Its purposes are to unify standards and general precepts relating to production as well as related factors, to establish standard types of goods, instruments, and machine parts, and to promote the distribution and adoption of unified standards.

A board of directors, composed of representatives of member organizations, is the controlling body of the UNI. To it projects are submitted for final approval as Italian standards. The technical work of preparing standards is carried on by technical committees, operating directly under the UNI or under affiliated or subordinate organizations. A central technical commission, composed of the presidents of the various technical committees and other particularly competent persons, reviews these projects, harmonizes them with similar domestic and foreign standards already published or in preparation, and publishes them for general comment and criticism.

Under the supervision of the old general committee for standardization in the mechanical industry, 128 standards were approved and published, covering such items as rules for technical drawings, various types of threads, normal diameters, tolerances and fits, bolts and screws, splines, limit gages, and keys and keyways. In its first year the new association has published standards on rivets, storage batteries, chamfers, roundings, and knurls. Other standards on bolts and screws and details of automobile equipment will be soon approved. Many of the published standards have been made mandatory for Government departments and public administrations.

JAPAN

Japanese Engineering Standards Committee (JESC), Y. Goto, general secretary, care of Bureau of Industrial Rationalization, Department of Commerce and Industry, Tokyo, Japan.

The Japanese Engineering Standards Committee, organized in 1921, now operates under the new Bureau of Rationalization, a di-

vision of the Department of Commerce and Industry. Although the committee functions as a governmental organization for preparing specifications for use primarily by the Government, steps are taken to obtain the suggestions of technical societies, trade associations, and manufacturing firms when the specifications are being prepared.

The preparation of standards involves the drafting of proposals by technical subcommittees, which are 33 in number, grouped under the four main headings of metals, nonmetallic materials, electrical machinery and instruments, and mechanical equipment and supplies. Foreign standards for similar subjects are taken into consideration. After the approval by the sectional meeting, drafts are brought before a general meeting of the committee for final approval as standards.

Japanese engineering standards are mandatory on the various governmental departments, by an order from the Department of Commerce and Industry. Further, steps are taken to encourage their use by Japanese industry. They are printed in both the Japanese and English languages.

According to the last report, the committee had completed 109 standards in the fields of building trades, civil, mechanical, electrical, and marine engineering, transportation, naval architecture, metallurgy, chemistry, and the wood, pulp, and paper industries. No information is available concerning the progress of activities during 1930–31.

NETHERLANDS

Hoofdcommissie voor de Normalisatie in Nederland (HCNN), J. A. Teyinck, secretary and director of the Centraal Normalisatie Bureau, Koningskade 23, The Hague, Holland.

During the year 1930, the General Committee for Standardization in the Netherlands issued 31 new standards and published 46 others for general comment and criticism, making a total of over 360 approved and 150 tentative standards.

These standards are prepared by technical committees, composed of representatives of producing, commercial, and consuming organizations, together with scientific experts. The 44 committees now functioning, together with their 49 subcommittees, have a membership of about 650 persons. The Central Standardization Bureau is the secretariat for these committees.

In its quarterly magazine, "Normalisatie," the general committee publishes a list of firms who manufacture products in accordance with certain Dutch national standards.

NORWAY

Norges Standardiserings-Forbund (NSF), Kaare Heiburg, director, Kongens gate 15, Oslo, Norway.

The formation in 1923 of the Norges Industriforbunds Standardiseringskomite (Standardizing Committee of the Federation of Norwegian Industries) on the initiative of the Federation of Norwegian Industries, practically marked the beginning of attempts at standardization in Norway.

The committee, which was organized in much the same way as similar committees in other countries, very soon became the recognized center for Norwegian industrial standardization, except in the electrical field, where standardization had already been taken up, and is still carried out, by several committees, especially the Norwegian national committee of the International Electrotechnical Commission.

The standardizing committee began its work on items, such as paper sizes, drafting-room practice, screw threads, limits and fits, bolt and nut proportions, shipbuilding details, and doors and windows for housebuilding.

Gradually the scope of the work was enlarged to include also nontechnical matters, with the result that a reorganization and change in name became necessary. Consequently, in April, 1931, the standardizing committee was converted into the Norges Standardiserings-Forbund (Norwegian Standards Association).

The work of the Norges Standardiserings-Forbund now covers not only industrial and technical standardization, but also standardization within the field of fisheries, agriculture, etc., including dimensional and commercial standardization as well as standardization of specifications, nomenclature, methods of test, and contract forms.

Members of the new association include all the institutions represented in the former body, together with several other members admitted at the time of reorganization.

The main committee, or board of representatives, consists of 35 persons representing the various technical societies, trade associations, and governmental departments interested in the Norges Standardiserings-Forbund. In this board is vested the right to give final approval to completed standards.

The controlling organ of the association is the board of directors, composed of seven members of the board of representatives. This body appoints or sanctions the appointment of members of the technical committees.

Most of the secretarial work, technical investigations, and preparation of drawings is handled in the general offices by a staff of five persons, including the director.

The technical committees, with their subcommittees, at present number 50, with a personnel of 225. Draft standards prepared by these committees are published for general criticism before being submitted to the board of representatives for approval.

The association is financed by voluntary contributions by member bodies and other interested organizations, and by a parliamentary grant amounting to about one-third of the total expenditures, which in the past few years have been between $10,000 and $12,000 annually.

Standardization is being carried out on the following subjects:

Civil engineering and housebuilding.—Doors and windows, moldings, bricks, builders' hardware, soil cisterns, building specifications, inquiries and contracts, steel structures, Portland cement and Portland cement concrete, and kitchen equipment.

Shipbuilding.—Bollards, side lights, rails, and cargo gears.

Ferrous metallurgy.—Cast and rolled iron and steel.

Mechanical engineering.—Drafting-room practice, threads and their tolerances, bolts, nuts, pins, washers, and keys, shafting and accessories, pipes and flanges, limits and fits, tools and machine tools, and couplings and shaft ends for machines and apparatus.

Agriculture.—Teeth for harrows and cultivators, axles and wheels, pulleys, packings for fruits and berries, vegetables, eggs, flowers, and cheese, and specifications and gradings for fruits and berries, vegetables, eggs and poultry, flowers, and cheese.

Fisheries.—Packings for herrings and other fish, fishing nets, and tackle.

Miscellaneous.—Paper sizes, sizes of matter planes for periodicals, direction labels, portfolios for letters and documents, and milling cutters for wood industries.

The number of approved standards is at present 248, of which 21 were approved and issued in 1931. They may be classified as follows:

	Number of standards
Paper sizes	8
Drafting-room practice	24
Mechanical engineering	137
Shipbuilding	5
Housebuilding (windows and doors)	56
Packings for agricultural products	10
Packings for fish products	8
Total	248

At the present time special attention is being paid to the standardization of the quality and packing of agricultural products, specifications, tender, and contract for house building, profiles for tools for dressing lumber, equipment for ship cargo gears, pipe flanges, and specifications for iron and steel.

The table below shows the number of projects on which work progressed during 1930 and the first half-year 1931.

	Number of projects
Mechanical engineering	27
Shipbuilding	15
Ferrous metallurgy	16
Miscellaneous	24
Total	82

The use of approved standards by industry is entirely voluntary. However, certain standards, including those on paper sizes, have been made mandatory for all governmental departments and many municipal offices. The standards on packings for fish and agricultural products are being very generally used throughout the country. The association is making a special effort through institutions of learning to popularize the standardization idea.

The Norwegian Standards Association, as a member of the International Federation of National Standardizing Associations, has

taken a keen interest in international standardization, and is maintaining a close connection with the other national standardizing bodies.

POLAND

Polski Komitet Normalizacyjny (PKN), A. Rogiński, director, Ministerstwo Przemyslu i Handlu, Elektoralna, 2, Warszawa, Poland.

The Polish Standardization Committee, organized in 1924 by the Minister of Commerce and Industry, prepares specifications for goods purchased by Government establishments and assists in establishing manufacturing standards for the industries of Poland. Three-fourths of its expenses are borne by industry, the remainder by the Ministry of Commerce and Industry.

Technical work is handled by 21 committees, which, with their 70 subcommittees and 12 sections, have a membership of about 500 persons. These committees cover ferrous metals, nonferrous metals, building construction, technics of the workshops, machine parts, machinery, automobiles, steam boilers, chemical technology, aviation, textiles, leather, ameliorations, classification of coal sizes, wheels and farm wagons, sanitation equipment, fire fighting, piping, oil industry, hospital equipment, and general matters.

The committee has completed and promulgated, with French translations, 359 standards. The technical committees are at work on 450 proposed standards, which may be classified as in the following table:

	Proposed standards
Agriculture	6
Aircraft	39
Automobiles	63
Chemical industry	33
Civil engineering and building trades	21
Ferrous metallurgy	10
Mechanical engineering	221
Mining	15
Nonferrous metallurgy	24
Textiles	11
Miscellaneous	7
Total	450

RUMANIA

Comisiunea Romana de Normalizare, P. P. Dulfu, secretary, 6 rue Clemenceau, Bucharest 3, Rumania.

Organized in 1928 by the Rumanian Institute of Scientific Management, the Rumanian Committee for Standardization has for its purposes the simplification of economic activity, coordination of standardizing activities, and representation of the standardization movement at home and abroad.

The organization is engaged in standardization on such subjects as a Rumanian technical dictionary, drill tubing for use in the oil industry, mechanical parts, transmission belts and forms of purchase specifications.

Working in the closest cooperation with the Rumanian Committee for Standardization, is the Rationalization and Standardization Office, which was established in 1930 by the Ministry for Commerce and Industry, for the formulation of specifications for materials purchased by the Government. This body makes use of standards prepared by the Committee for Standardization and foreign standards on subjects for which Rumanian standards do not exist. In 1930 it established standards for paper sizes and prints.

SWEDEN

Sveriges Standardiseringskommission (SIS), Amos Kruse, managing director, Malmtorgsgatan 10, Stockholm 16, Sweden.

Due to rapid advances made in the field of standardization, the scope of the Swedish Industrial Standards Committee, organized in 1922 at the initiative of the Swedish Industrial Association, was during the last year enlarged to include certain forms of standardization not purely industrial. At the same time, the name of the organization was changed to the Standards Commission of Sweden.

The standards commission supervises and coordinates the work of standardization in the various fields of Swedish industry. Its membership is representative of industrial and scientific organizations and Government departments. Finances are handled largely by a Government subsidy.

The latest progress report lists 395 standards which have received the commission's approval, with 225 new projects under way. The status of work according to industrial groups is as shown in the table.

Industrial groups	Under way	Approved	Total	Revisions
A. Civil engineering and building industry	18		18	
B. Mechanical engineering	99	329	428	11
C. Electrical engineering	15	34	49	
E. Transportation	16		16	
F. Shipbuilding	1		1	
G. Ferrous metallurgy	2	1	3	
M. Mining	62		62	
N. Agriculture	5	23	28	
O. Wood industry	2		2	
P. Pulp and paper industry	1		1	
R. Glass and pottery	2		2	
Z. Miscellaneous	2	8	10	
Total	225	395	620	11

Standardization in many industries is carried on by organizations working under the direction of the Standards Commission. These bodies include the Swedish Society of Mechanical Engineers, the Electrical Standardizing Commission, the office for the Promotion of the Iron and Steel Industry, the Committee for the Standardization of Building Materials, and the Technical Society for Agriculture.

SWITZERLAND

Schweizerische Normalien-Vereinigung (SNV), H. Zollinger, secretary, Zurich, Lavaterstrasse 11, Switzerland.

Swiss standardization is carried on mainly under the auspices of the Verein Schweizerischer Maschinen-Industrieller (VSM), or As-

sociation of the Swiss Machine Industry, which maintains an office of its own, the VSM Standards Bureau. This body carries on standardization on such subjects as drawings, steel, bronze, brass, aluminum, wire rope, steel pipe, cables and conduits, screw threads and tolerances, bolts, nuts, screws, washers, pins, rivets, and keys, springs, standard diameters, bearings, hand grips, axle heights, shaft ends, couplings, pipe systems, pipe unions, fittings, hand tools and machine tools, cones, pressure and vacuum gauges, thermometers, and stopcocks.

In addition to the VSM, there exists the Schweizerische Normalien-Vereinigung (Swiss Standards Association), which at the present time is still a rather loosely knit organization in which paper sizes, hose couplings for fire-fighting equipment, electric attachment plugs, letter heads, and promotion pamphlets for travel and transportation are developed. The VSM Standards Bureau was designated as the central office.

Problems of rationalization are dealt with by the Scientific Management Institute of the Federal University, which is financed both by industry and by the Government.

An effort toward the elimination of waste in labor is being made by the Commission Romande de Rationalisation, which was formed to popularize the rational organization of labor by the distribution of propaganda, and to aid its practical application. The commission is composed of representatives of industry, agriculture, arts and sciences, commerce, and public and private administrations.

UNION OF SOVIET SOCIALIST REPUBLICS (RUSSIA)

All-Union Standards Committee, State Planning Commission, F. W. Lengnik, president, Razin Street 12, Moscow, U. S. S. R.

The standardization movement is having in the Soviet Union perhaps its most important application, considered from the standpoint of its centralized planning and direction, its emphasis on quality specifications for materials and manufactures, and the mandatory adoption of standards throughout the industry. It is generally believed that this movement is the greatest single factor contributing to the growth and quickening of the country's industrial life.

The essence and actual content of socialistic standardization is defined as planning quality, a combination of procedures to eliminate waste in production and building; such standardization aims at modern technological processes, close typization, simplification, reduction of sizes and shapes, and the establishment of quality specifications. The organizing center for the carrying out of these measures is the All-Union Standards Committee.

The standards committee, with a staff of 450 regularly employed persons, is the largest of the national standardizing bodies. The organization is divided into the following sections: Planning and economic, scientific and technical, military, organization and control, and popularization and press. Also functioning under the committee are the Main Chamber of Weights and Measures, which, with its 28 research laboratories, supervises general adherence to standardization laws; the International Standardization Bureau, recently organized to act as the official channel for the cooperation of the Standards Committee with national standardizing bodies in other countries;

the Simplification Committee; the Supreme State Quality Inspection, with subdivisions on coal, naptha, metals, and chemistry; and standardization groups for power, mining and fuel, metallurgy, mechanical engineering, agricultural engineering, shipbuilding, automobiles and tractors, electrical industry, chemical industry, welding, building materials, building standards, transportation, precision mechanics, textiles, clothing, leather and footgear, woodworking, paper and printing, ceramics, agriculture and foodstuffs, sanitary and medicinal, safety codes, and general standards.

The work of standardization is being intensely pushed, and is proceeding on an ever-widening scale. Not only are individual products and parts being standardized, but whole installations and buildings are coming within the scope of the movement. For instance, in the metal industry, blast furnaces and open-hearth plants are being designed on standard lines, the sizes and shapes of metal products are being standardized, and so on, to the machine building and construction industries which use these products. In addition to the standardization of parts and accessories of industrial and residential buildings, a start has been made in the design of entirely standardized structures.

It may be interesting to note the extent, in various industries, to which it was expected that standardization would be applied at the end of 1931.

Industry	Percentage of standardization	Industry	Percentage of standardization
Coal mining	100	Wood industry	73
Leather industry	95.2	Nonferrous metallurgy	70
Building materials	91	Petroleum industry	61.3
Glass and porcelain	88	Metal mining	60
Canned goods	85.5	Electrotechnics	53.7
Textiles	83.5	Machine construction	28.7
Ferrous metallurgy	75.5	Packing materials	26.9
Chemical industry	74.6		

The number of approved standards has increased rapidly each year, from 42 in January, 1927, to 2,888 in July, 1931. The general plan for 1931 involved nearly 6,000 projects on which work was to have gone forward. Of these projects, 4,562 were to have been completed and put into effect; the remainder were to be carried over into 1932.

The distribution according to industrial groups of standards adopted up to July 1, 1931, is illustrated in the following table.

Industrial groups	Standards	Industrial groups	Standards
Agriculture	261	Petroleum industry	25
Building	134	Power generation	3
Building materials	43	Silicates and ceramics	83
Chemistry	279	Textiles and clothing	214
Electrotechnics	33	Transportation	219
Foodstuffs	271	Woodworking	29
Leather and furs	114	Miscellaneous	51
Metal working	1,059		
Paper manufacturing and printing	70	Total	2,888

While the great rapidity with which standards are being turned out is due in great measure to the planning and energy of the standards committee, consideration must be taken of the fact that many of the standards deal with simple, commonplace articles concerning which the need for standardization is too evident to justify argument, results being thus quickly and easily obtained.

It is claimed by the Soviet standards committee that great savings have been made in the past, and still greater savings will be effected in the future, in all of the industries in which standardization is being applied. The recently introduced standards of structural design set forth new specifications for building construction, raising allowable stresses for iron and steel, lumber, and cement, and reducing dimensions and weights of walls, roofs, and foundations. It was estimated that these standards would bring about an over-all reduction of 3 per cent in total construction costs, which should effect a savings in 1931 of from $425,000,000 to $450,000,000.

It was thought that through a reduction from 150 styles of shoes to 35, $15,000,000 would be saved in 1931, while the standardization of shoe packing and boxing would bring about a further economy of $2,500,000.

Simplification has been actively carried on in the field of textiles. In cotton textiles, 3,500 assortments have been reduced to 400. In woolen goods, an assortment of 600 combed wool items were reduced to 20, 250 thin-cloth items to 35, and 100 heavy-cloth items to 19. Two thousand five hundred linen items were reduced to 180. It was estimated that in 1931 there would be saved 3 per cent of the total cost of production, or $33,000,000.

Even in the standardization of minor items appreciable reductions have been made in the cost of manufacture. By simplifying the assortment of pins and hooks and eyes, and by packing them in paper instead of cardboard, $50,000 a year has been saved. By the prescription of a standard round bottle for acetic acid, $20,000 was saved in 1931.

The standardization movement is being actively propagated by the publications "Standart," the first issue of which appeared in January, 1931, and "Vestnik Standartizatziyi" (Standardization Review), a monthly scientific and engineering journal which is the official organ of the standards committee.

UNITED STATES OF AMERICA

American Standards Association (ASA), P. G. Agnew, secretary, 29 West Thirty-ninth Street, New York, N. Y. (*See* Chap. VIII, p. 281.)

V. FEDERAL STANDARDIZING AGENCIES (U. S. A.)

The Federal Government is probably the largest single purchaser in the world. Among its various activities, it is continuing its work in the standardization of its purchasing and specification activities with the ultimate view of economy. It is assisting industry to standardize and simplify its products. It is aiding in the protection of its citizens by regulations governing the production and sale of foods, and by the benefits of its continuous research and testing in medicine, science, and engineering. Information concerning earlier standardizing agencies activities and accomplishments of the Government can be found in the Standards Yearbooks of 1927 to 1931, inclusive.

EXECUTIVE DEPARTMENTS

DEPARTMENT OF AGRICULTURE

BUREAU OF AGRICULTURAL ECONOMICS

New standards for farm products promulgated during the year include those for sweet anise, asparagus plumosus, red sour cherries, parsley, unshelled pecans; and lamb, yearling mutton, and mutton carcasses and cuts. The standards for canned corn (cream style), canned corn (whole grain), canned peas, and canned tomatoes, hitherto considered as tentative, have been promulgated by the Secretary of Agriculture.

Tentative standards for canned sauerkraut are under test by practical use. Tentative schedules of market classes and grades of hides and skins and tentative market classes and grades of kips and calfskins have been developed and are being used for educational and demonstration purposes.

Several of the standards already in use have been revised during the year.

Following the address of the chief of the bureau on "Development of Federal Standards for the Certification of the Farm Products in the United States" before the International Conference of Agricultural Economists at Ithaca, N. Y., in August, 1930, the bureau has taken especial interest in checking up its advancement in the use of mechanical devices and chemical and physical tests both in the formulation of standards and in grading under the standards. A compilation and photographic file based on this check up is now being formed for the information and use of the bureau specialists.

The complete Check List of Standards Formulated by the Bureau of Agricultural Economics has been revised, as is the annual custom, and is available to the public in mimeographed form.

BUREAU OF AGRICULTURAL ENGINEERING

This bureau is cooperating in standardization activities with the following:

Federal Specifications Board

Technical Committee on Spraying Machines.—A representative of this bureau is chairman of this committee. The purpose is to prepare standard specifications for machines for spraying insecticides. Information is being collected from Government agencies regarding the types of machines they purchase in order to arrive at a basis for determining just what specifications are needed.

Heat Insulating Materials Committee.—The bureau is represented on this committee.

National Fire Protection Association

Farm Fire-Protection Committee.—The bureau has a representative on this committee. A report has been published by the United States Department of Agriculture in Farmers' Bulletin No. 1590, "Fire Protection Construction on the Farm."

Department of Commerce

National Committee on Wood Utilization (Subcommittee on Insulation).—The bureau has one representative on this subcommittee. The national committee is preparing a bulletin on the use of insulation in dwellings and certain other types of structures.

American Society of Agricultural Engineers

Committee on Fuels and Lubricants.—This committee, on which the bureau has two members, is making studies preliminary to recommending standard specifications for fuels and lubricants for use with farm machinery and farm power units.

American Society for Testing Materials

Committee C–6, Drain Tile Specifications.—The bureau has two representatives on this committee, the function of which is to recommend specifications for concrete and clay drain tile that are abreast of current information and development in this field.

BUREAU OF CHEMISTRY AND SOILS

Industrial Farm Products Division

The industrial farm products division of this bureau participates, through a representative on the paper specifications committee of the Joint Committee on Printing of Congress, in the preparation of specifications and schedules for papers for the public printing and binding. This division is also represented on the technical committees on paper, paints, and oils, and leather products of the Federal Specifications Board. The division cooperates with the American Society for Testing Materials, the Association of Official Agricultural Chemists, the American Leather Chemists' Association, the Tanners Council of America, and The Pine Institute of America in developing and standardizing methods for the examination of materials.

BUREAU OF ENTOMOLOGY

This bureau has cooperated with the Bureau of Agricultural Economics in the work on grades, color standards, and packing requirements for honey, as described in Circular No. 24, of the Department of Agriculture, issued in 1927. These rules for grading honey are for the guidance of beekeepers in preparing honey for the market and for convenience in buying and selling. "The Color Grading of Honey," Department of Agriculture Circular No. 364, contains other information helpful in grading and packing honey.

BUREAU OF HOME ECONOMICS

This bureau is cooperating with the American Standards Association in the consideration of specifications for household refrigerators, sheets, silks, and blankets.

A representative of this bureau serves as a member of the Committee on Standardization of Consumers' Goods of the American Home Economics Association. There are also representatives of this bureau on a committee of the National Electric Light Association, setting up directions for use of various types of household electrical equipment. While this is not a standard specifications committee, the information assembled may be used in formulating specifications.

BUREAU OF PLANT INDUSTRY

Seed Laboratory

This laboratory is represented on committees of the International Seed Testing Association, and continues to participate in the Association of Official Seed Analysts of North America, in formulating rules for testing seeds.

There is continued activity toward placing the work of all seed-testing laboratories on a more practical basis to the extent that the reports of analysis will more accurately indicate the plant-producing value of the seed.

BUREAU OF PUBLIC ROADS

The bureau has continued the work of standardization of specifications for Federal-aid highway construction, particularly in those sections relating to administrative control, legal and business relations, and measurement and payment for completed work.

A large part of the standardization activities of the bureau have been in cooperation with technical committees of various national organizations interested in the development of specifications for highway materials and standard methods of testing such materials.

Cooperation with the American Association of State Highway Officials.—The bureau is represented on committees of this organization as follows:

Committee on Materials.—This committee is engaged in the development of standard specifications and standard methods of testing highway materials. During the past year all of the standards of the association sponsored by this committee have been revised and published by the association under the title "Tentative Standard Specifications for Highway Materials and Methods of Sampling and Test-

ing." The bureau is represented on this committee by four members, one of whom acts as secretary of the committee.

Committee on Bridges and Structures.—During the past year this committee has prepared for publication standard specifications for bridges which have been adopted by the committee. These specifications have been published by the association under the title Standard Specifications for Highway Bridges and Incidental Structures." This committee is continuing its work on specfications for movable bridges. The chairman of this committee is a member of the bureau staff.

Subcommittee on Accounting.—This subcommittee is working on the standardization of accounting procedure and accounting definitions used by highway organizations. Such standardization will greatly assist in making comparison of similar work done by different agencies. It is planned eventually to issue a manual on the subject. The chairman of this subcommittee is a member of the bureau staff.

The bureau also has representatives on three special committees of the association engaged in the preparation of specifications for concrete, bituminous macadam, and mixed bituminous pavements. A complete specification which was prepared last year by the Committee on Concrete Specifications is now being revised by the committee. The other two special committees have not been active.

Cooperation with the American Society for Testing Materials.—The bureau is cooperating with this society through membership on nine of its technical committees, as follows:

The committee on steel: Developing specifications for structural steel for bridges and specifications for reinforcing steel.

The committee on cast iron: Preparing specifications for cast-iron culvert pipe with special reference to its use in the construction of highways.

The committee on corrosion of iron and steel.

The committee on cement: Developing standard methods of testing and specifications for Portland cement.

The committee on brick: Developing specifications and methods of testing brick for various types of construction.

The committee on clay and concrete pipe: Preparing specifications for clay and concrete pipe for various purposes. The bureau is primarily interested in specifications for pipe for use in the construction of road culverts.

The committee on concrete and concrete aggregates: Preparing specifications for testing the flexural strength of concrete. The bureau conducted laboratory tests, the results of which were used in connection with the preparation of a new tentative standard specification for sand for use as concrete aggregates, adopted during the past year by the society.

The committee on road materials: Engaged in the preparation of standard methods of testing various materials used in the construction of roads, such as stone, gravel, slag, asphalt, and tars.

The committee on methods of testing: Standardizing procedure for determining the size of mineral aggregates. The committee has recommended to the parent society that specifications for sizes of coarse aggregates used in highway construction be based on the use of sieves having square openings, and that the various methods of tests and specifications of the society be revised in accordance with this procedure.

Cooperation with Other Agencies.—The bureau is continuing to cooperate with the American Concrete Institute, with special reference to the matter of specifications for concrete aggregates.

Cooperation with the Highway Research Board is through membership on the following committees: Structural design of pavements; materials and construction; methods of curing concrete; specifications for rail steel for reinforcement; and aggregates.

This body is not primarily a standardization organization, but is engaged in the coordination of the research activities of other agencies, the results of which may be used in the development of standards.

The bureau is represented on a number of committees of the Federal Specifications Board, as follows: The committee on road and paving materials; the committee on cements, limes, and plasters: the committee on lubricants and liquid fuels; and the committee on metals.

All of these committees have been active during the past year in their particular fields. The committee on road and paving materials, of which the chairman is a member of the staff of the bureau, in cooperation with a joint technical committee of the mineral aggregates associations, has adopted a standard series of sizes for coarse aggregates for use in highway construction, based on the use of square opening sieves. This committee is likewise actively engaged in the preparation of specifications for asphalt emulsions.

The bureau is cooperating with the asphalt industry and the State highway departments in a study of the various classes of liquid asphaltic products which are being used extensively in the construction of low-cost bituminous roads. Laboratory tests are being made for the purpose of evaluating the various products which are available, both by means of the tests now specified and by means of a proposed common scheme of analysis. The data resulting from this study will be used as the basis for future agreements on uniform test procedure and uniform specifications.

The bureau is represented on sectional committees of the American Standards Association as follows: Portland cement; road materials.

FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration of the United States Department of Agriculture is charged with the enforcement of six Federal laws—the food and drugs act, the tea act, the insecticide act, the naval stores act, the import milk act, and the caustic poison act. Specific standards for the commodities covered are established by some of these acts and standards are adopted by the Secretary of Agriculture for use in the enforcement of others.

Food and Drugs Act

Food Standards.—A standard for butter was established for use in enforcement of the Federal food and drugs act. In general, however, the definitions and standards of identity for food products subject to the act are recommended by the Food Standards Committee appointed by the Secretary of Agriculture.

During the year definitions and standards were adopted for dextrose, anhydrous dextrose, hydrated dextrose, for canned tomato juice and for whole-wheat bread. These new definitions were covered in a press notice dated June 20, 1931, and pamphlet known as S. R. A., F. D. No. 2, revision 1. Revised definitions and standards were adopted for sorghum sirup, white bread, raisin bread, and Boston brown bread. These were included in the press notice.

An announcement covering the use of corn sugar (dextrose) in manufactured food products was issued in January, 1931, as Supplement 3 of S. R. A., F. D. No. 2.

Tentative definitions were proposed for farina macaroni, farina spaghetti, farina vermicelli, and for revisions of the definitions for milk bread and rye bread. These are covered in press notice dated June 29, 1931. These definitions have not yet been formally adopted.

The definitions and standards for food products are given in S. R. A., F. D. No. 2, revision 1, and supplements which supersede the definitions for similar products published in the body of the pamphlet.

An amendment to the food and drugs act approved July 8, 1930, authorized the Secretary of Agriculture to establish standards for quality, condition, and/or fill of container for canned food products; except meat, meat products, and milk. Under this amendment standards have been adopted for canned peaches, canned pears, canned peas, canned tomatoes, canned apricots, and canned cherries. These are embodied in S. R. A., F. D. No. 4, revision 1.

Drugs.—The Federal food and drugs act makes the standards for drugs prescribed by the United States Pharmacopœia and the National Formulary the legal standards in the United States. There are approximately 1,000 such drugs. The Department of Agriculture is actively cooperating with the committees of revision of both the Pharmacopœia and the National Formulary, and cooperation between the Food and Drug Administration and the combined contact committee of the American Drug Manufacturers Association and the American Pharmaceutical Manufacturers Association, begun several years ago, has continued during the past year.

Tea Act

Objective tea standards, prepared and submitted by the board of tea experts, have been fixed and established as standards under the tea act for the year beginning May 1, 1931, and ending April 30, 1932. (Circular S. R. A., T. No. 5.)

FOREST SERVICE

The Forest Products Laboratory at Madison, Wis., a branch of the Forest Service, is represented in the following standardization activities:

American Standards Association.—Committee on Wood Poles.—As a result of the work of a subcommittee on which the laboratory is represented, ultimate fiber stresses for nothern white cedar, western red cedar, chestnut, and creosoted southern yellow-pine poles were adopted as an American standard. These stresses automatically become part of the National Electrical Safety Code, which is widely used as the standard of pole-line design and construction by the various State regulatory bodies having supervision over public utilities. Other work accomplished by the committee was the completion of specifications and of new dimension classifications for poles of the species named. The specifications were approved as tentative American standards and the dimension classifications as American standards. Further work on the program of the committee is the creation

of standard fiber stress specifications and dimension classifications for Douglas fir and lodgepole-pine poles.

Federal Specifications Board.—Committee on Glue.—The committee's specification for animal glue for woodworking was adopted by the board.

The Forest Products Laboratory took an active part in the preparation of specifications for shipping containers which were adopted by the board.

American Society for Testing Materials.—Committee C–5 on Fire Tests of Materials and Construction.—Subcommittee II on fire tests of lumber has been working on standardization of fire tests for treated and untreated lumber. The development of the fire-tube test has featured the work of the past two years. Tentative specifications have been prepared, and will be considered during the coming year.

The Forest Products Laboratory is taking an active part in the preparation and revision of specifications for shipping containers, under the jurisdiction of Committee D–10. Specifications are being promulgated or revision of present specifications made for solid fiber and corrugated fiber containers, on nailed and locked-corner containers, on wire-bound containers, on wooden crates, and on plywood containers.

Technical Association of the Pulp and Paper Industry.—Alkaline Pulping Methods Committee.—Members of the Forest Products Laboratory acting on this committee have cooperated in the preparation of a set of standard definitions of terms used in soda and sulphate pulp mill recovery-room practice. These definitions are now before the main body of the association for adoption.

Other standardizing agencies served by the laboratory staff members include: The American Mining Congress, the American Railway Engineering Association, the American Wood Preservers' Association, the American Chemical Society, the American Institute of Chemical Engineers, the American Paper and Pulp Association, the American Society of Civil Engineers, and the Building Code Committee of the Department of Commerce.

DEPARTMENT OF COMMERCE

AERONAUTICS BRANCH

Standardization plays an important part in those activities of the Aeronautics Branch which have to do with the establishment and maintenance of aids to air navigation on the Federal airways system and with regulatory duties involving licensing and approval of airmen and aircraft and subjects related thereto. In addition, certain phases of the branch's obligations pertaining to the promotion and development of aeronautics, lend themselves very favorably to standardization.

Uniformity is a particularly essential factor in the establishment and maintenance of the Federal airways in order to simplify their use by airmen and at the same time to provide for their maximum effectiveness. All airway lights, intermediate landing fields, communication facilities, and other aids to air navigation are standard-

ized. The beacon lights and intermediate landing fields are spaced at regular intervals; the fields are similarly marked, lighted, and operated; and the radio-communication stations, which provide airmen with weather information, as well as the radio range beacons which outline their courses for them by radio signals, and the automatic telegraph typewriter circuits, all function uniformly.

This standardization enables airmen to find the same types of aids to air navigation on the Federal airways in every section of the country where they are in operation.

Uniform methods are also followed by the Aeronautics Branch in discharging its functions pertaining to the licensing and approval of aircraft and airmen. A manufacturer seeking approval for an aircraft or engine, or an airman seeking a license, knows definitely what qualifications are necessary in order to receive an approval or a license, with the result that unnecessary effort and expensive waste are eliminated. This applies to all the licensing and approval activities of the Aeronautics Branch, which include the licensing of aircraft and airmen, approval of aircraft engines, repair stations, flying and ground schools, parachutes, interstate scheduled air-passenger lines, and aircraft components and accessories.

Other standardization activities in which the Aeronautics Branch is engaged are as follows:

All aeronautical lights, except those established and maintained by the Federal Government, are required to be certified if they serve as true aids to air navigation.

Recommended standards for the air marking of cities, towns, and communities, so that airmen may know their positions and landing facilities offered by the types of marking shown on roofs or other available area.

Recommended standards for air marking of Federal and State highways by official route numbers.

Recommended standards for marking obstructions to air navigation.

The rating of airports, upon request of the owner, as to the general equipment and facilities, the effective landing area, and the aeronautic-lighting equipment.

Research work looking toward the development of standard signal systems for airports. Suggested uniform field rules for airports.

BUREAU OF THE CENSUS

The bureau has continued its efforts to promote adherence by all States to the International List of Causes of Death as a means of promoting uniform classification of the causes of death on death and stillbirth certificates. The conference for the fourth decennial revision of the international list was held in Paris in October, 1929, and was attended by representatives from our own and 37 other countries. During the past year the fourth edition of the Manual of the International List has been prepared for use in the United States. Besides this important aid toward standardization of mortality statistics, the bureau has issued a new edition of the booklet known as the Physicians' Pocket Reference to the International List of Causes of Death. Copies of this booklet have already been distributed to all State departments of health and through them to

undertakers and local registrars. Work has also been commenced on the preparation of the new Manual of Joint Causes of Death. This new manual will include a number of pages devoted to the presentation of rules and exceptions which have been used by statistical offices of different countries as a basis for selecting the particular cause of death to be tabulated when joint causes were certified.

In connection with the White House conference, and as an aid to the standardizing of maternal mortality rates, the bureau submitted to each of 27 countries a test list of 1,000 certificates of maternal deaths. The purpose of this test is to standardize the practice of the several countries with respect to the nosological assignment of puerperal causes of death.

The bureau announced the adoption of the new standard certificate of death and the new standard certificate of birth for use beginning with the calendar year 1930. Up to the end of the past fiscal year 31 States had adopted this standard certificate as a basis for the original State certificate from which the Bureau of the Census secures a transcript for the tabulation of the Federal statistics. Indications are that most of the remaining States will begin the use of the new form when their present supplies of certificate blanks are exhausted.

In securing the adoption of the standard birth and death certificates, the bureau has had the cooperation of the American Public Health Association, and of the Conference of State and Provincial Health Officials of North America.

BUREAU OF FISHERIES

Although the functions of the Bureau of Fisheries, as originally outlined, did not specifically include standardization activities, several such activities have become necessary as a means of carrying out the principal function. The bureau has only advisory functions in this respect.

Improvements in the Handling of Fresh and Frozen Fish.—One of the primary duties of the technological staff of the bureau includes the making of studies for improving methods for handling various marine products from the time they leave the water until they reach the consumer. In the preparation and preservation of the finished or manufactured product, standardization of processes and containers naturally reduce losses, increases efficiency, and even helps toward expanding markets for these products, as a standard product can be much more readily introduced to and maintained in the market. Particularly is this the case with modern developments in the refrigeration of fish and the handling of fresh and frozen packaged fish. In this industry standardization is a necessity. Uniformity of containers in a continuous process where the efficiency of the machinery counts, as well as uniformity of the container in which the finished product is marketed, is essential.

Net Preservation.—Technologists of the bureau for many years have been carrying out investigations to evolve standard chemical preservative treatments for prolonging the life of fishing nets of various kinds.

Based on tests with nets, webbing, and twine certain principles of preservation and the application of preservatives have been stand-

ardized. Progress has been made upon the standardization of the chemical components of preservatives.

There is serious need for a standard method for the measurement of the meshes of fish nets. This is especially required for gill nets upon the Great Lakes where the regulations of six States and one Canadian Province differ widely. The problem is complicated by the possibility of at least 10 variables for each size of plain webbing. With the cooperation of the Bureau of Fisheries, the division of weights and measures of the Bureau of Standards has been conducting extensive experiments to determine certain principles upon which a standard method of mesh measurement may be established.

Production Methods.—The bureau's technological staff also conducts engineering studies designed to improve existing methods of production and to evolve new methods of production for the manufacture of fish flour, fish meal, fish oil, and related by-products, with a view toward standardizing present practices and methods of production, thereby decreasing losses now encountered, and with a view toward producing a uniform standard product of high quality.

Nutrition.—Inasmuch as marine products represent an important food industry, and dietary standards are constantly being changed due to modern researches, it is necessary that the nutritive value of marine products be thoroughly investigated, first, to determine the basic food value of these products, and second, to study the effect of various methods or standards of manufacture on the nutritive value of the finished product. Furthermore, nutrition experiments demonstrate new standards of value and of usage for the various marine products and by-products. These nutrition experiments also furnish data useful in evaluating these products on the basis of the nutritional factors contained therein. For instance, biochemical research has demonstrated these products to be an excellent source of minerals, as well as of proteins and vitamins, and marine products may prove to be valuable sources of standard mineral supplements.

BUREAU OF LIGHTHOUSES

The standardized structural-steel skeleton towers now ranging from 15 to 100 feet in height and used for the purpose of exhibiting the lower orders of lights will be extended to include heights up to 150 feet for the purpose, if necessary, of exhibiting more powerful lights.

In the present system of standardized lights using compressed acetylene gas as the illuminant, the gas has heretofore been conveyed through delivery pipes of short lengths. In a number of cases recently acetylene lights have been placed at great heights where it is arduous to convey the tanks, and it has been found feasible to place the tanks near the shore and pipe the gas over great distances, in one case about three-eighths of a mile, to the lights.

The lighted buoys using compressed acetylene gas for the illuminant until recently employed a method of delivering the gas to the lantern through pipes inclosed in part within the body of the buoy. This method having been found very dangerous, a new method, more or less standardized to suit the make of the buoy, has been adopted, by which the delivery pipe and its connections are attached outside of the buoy, preventing dangerous accumulation of leaking gas.

Where a light station is provided with a flashing light, aerial fog signal, and radiobeacon, the characteristics of these aids have heretofore been operated through three separate mechanisms. An apparatus have been designed which will control all the characteristics in itself, and will no doubt inaugurate a standardized method for future installations.

The radiobeacons of the Lighthouse Service are now recognized to be all weather aids to navigation instead of simply fog signals as originally suggested. The standard schedule now being introduced provides for operation for 15 minutes out of each hour, and 68 stations' signals are now sent hourly or oftener in clear weather as well as continuously in fog.

A test of a 1,000-watt electric lamp with a special filament for use on lightships has been underway for nearly a year at the General Lighthouse Depot. This lamp provides a wider angle of divergence, making it less likely that the light will be eclipsed through the rolling of the vessel. The tests have demonstrated the durability and efficiency of the lamp, making it desirable to adopt such lamps as standard for use in the masthead signals of lightships.

BUREAU OF MINES

Many of the investigations carried on by the Bureau of Mines extend over several years. Included among these are the following, concerning which detailed information was given in the Standards Yearbook, 1931:

Methods for sampling, analysis, and testing of coal; plasticity of coal; methods for determining the agglutinating value of coal; methods for determining the melting point, plasticity range, and setting temperature of coal; gas, coke, and by-product-making properties of American coals; classification of North American coals; accelerated method for determining the slacking properties of coal; methods for determining coal friability; comparison of tests for determining strength of explosives; specifications for lubricants and liquid fuels and methods for sampling and testing; measurement of flow of gases; improved apparatus for the quantitative air separation of very fine sizes of powders; Mine Safety Board; experimental mine; coal-mine ventilation code; ventilation requirements of metal mines; mining-community health and safety work; uniformity in the methods at first-aid contests; mine-gas indicators; gas masks for use in mining, metallurgical, and allied industries; mine-rescue methods and apparatus used in mine-rescue work; mine-safety standards; methods for reporting mine accidents; uniform mine accident statistics.

Below are given outlines of developments made during 1931 in the above-mentioned investigations and certain other investigations inaugurated in 1931.

Plasticity of Coal.—Plasticity values determined by a method previously developed in the Bureau of Mines' laboratories are being correlated with the coking properties of representative coals.

Method for Determining Agglutinating Value of Coal.—A tentative test procedure has been developed for determining the agglutinating value of coal. Study is being made of the various factors which

affect the method of test with a view to standardizing the test procedure.

Methods for Determining the Melting Point, Plasticity Range, and Setting Temperature of Coal.—Results from the determination of the melting point, plasticity range, and setting temperature of coal on being heated under coking conditions with a view to developing standard procedures for these determinations are being compared with carbonization tests on the same coals to discover any relationship which may exist between these physical properties of the coal and its behavior on coking.

Methods for Determining Coal Friability.—The standard test procedure developed for determining the friability of coal has been applied to various ranks of coal, and the results show it to be indicative of the resistance of a coal to breakage in handling.

Methods for Determining the Burning Characteristics of Fuels in Domestic Heaters.—The ultimate criterion for the value of a fuel for a given purpose and the relative characteristics of fuels when so used are obtained by full-size burning tests; but it is difficult in such tests to separate the effects of the characteristics of the fuels from those of the particular apparatus used and the chances of control and the human element. Methods of tests have been developed by which the burning characteristics are separated from other factors. The test has been applied to coke and anthracite.

Methods for Studying the Burning Characteristics of Fuels Burnt on the Underfeed Principle.—Methods have been developed for studying in the laboratory the burning characteristics of solid fuels burnt on the underfeed principle.

Combustible Gas Detector.—In the course of the investigation of manhole explosions there has been devised and perfected a portable detector for combustible gases, with which tests of the character of the atmosphere in the manhole may be made at the manhole. The results thus obtained have checked with regular gas analyses of the same atmosphere.

Schlieren Photography Developed for Explosives Testing.—Pressure waves and the movements of invisible gases have been photographed by the use of an apparatus of special design. With this device the pressure waves and gases set out after an explosive has been detonated have been rendered visible by an optical arrangement which utilizes the change in the refractive index of a gas when compressed. With the apparatus thus standardized the behavior of different explosives under detonation may be compared.

Comparison of Tests for Determining Strengths of Explosives.—A comparison of the Trauzl lead block and the ballistic pendulum for determining strength of explosives shows that the relative order of strength as determined by the two methods is practically the same, but the lower grades give a lower absolute strength measured with the Trauzl block than with the ballistic pendulum, whereas with the higher grades the results obtained for absolute strength are much the same with both types of apparatus.

Standards for Permissible Electrical Mine Equipment.—The Bureau of Mines, in cooperation with the manufacturers of electrical mine equipment, has prepared safety standard or schedules under which a large variety of electrical equipment intended for use in gassy and

dusty bituminous coal mines has been inspected and tested. Safety specifications for units for cutting, conveying, and loading coal and for electric drills, air compressors, rock-dusting machines, electrically operated mine pumps, portable electric lamps, shot-firing units, safety lamps, etc., have been developed.

Development of Specifications for Mine Stoppings.—The Bureaus of Mines and Standards have cooperated in studying the strength of mine stoppings of various designs. From the results, specifications have been drafted for stoppings to withstand explosion pressures of 50 pounds per square inch.

Rock-dust Barriers for Limiting Coal-Dust Explosions.—An investigation of rock-dust barriers for limiting coal-dust explosions has been completed, and specifications drafted for these barriers for general and special use.

Specifications for Rock Dust.—An investigation of the most effective size of rock dust for limiting mine explosions has shown that there is little difference in the effectiveness of the sizes finer than the coarsest permitted by the specifications approved by the American Standards Association.

Specifications for Lubricants and Liquid Fuels and Methods for Sampling and Testing.—The specifications for motor fuel mentioned in the 1931 Yearbook as being in tentative form, were adopted by the Federal Specifications Board during the present year. A revision of the Federal specification for automobile lubricating oils was also adopted. The Bureau of Mines participated in the preparation of these specifications in connection with the work of the Technical Committee on Lubricants and Liquid Fuels of the Federal Specifications Board.

Two gasoline surveys were made to determine the quality of motor fuels marketed at service stations in 20 cities throughout the United States. The surveys this year were more comprehensive in regard to the number of samples taken as well as in the detailed examination of each sample, than had been the case for the surveys of the past several years. These gasoline surveys are a source of information in regard to the commercial standard for motor fuel throughout the United States at the time the surveys are made, and form a basis for judging the applicability of proposed revisions of Federal specifications for motor fuels.

Measurement of Flow of Gases.—The Bureau of Mines, in cooperation with the Bureau of Standards and the American Gas Association, has continued work on stndardizing methods for measuring natural gas. After an extensive study of the factors governing the flow of gas through pipe lines, it was concluded that the Weymouth flow formula is sufficiently accurate for design and operating purposes and is the most practical for all ranges of size and conditions of commercial gas pipe lines. This study has shown the advantages of keeping the pipes clean inside and the economic benefits of keeping the pressure drop at a minimum.

Study of the problems involved in the determination of the open-flow capacity of gas wells has given the natural-gas industry a proved method of gaging gas-well capacities, and has also had other successful applications. Among these are (1) forecasting drilling requirements, (2) determining the presence of cavings in wells, (3) design-

ing gathering systems, (4) determining operating pressures, (5) estimating costs of production, and (6) judging the advisability of storing gas in sands.

Improved Apparatus for the Quantitative Air Separation of Very Fine Sizes of Powders.—The air elutriator reported in the 1931 Yearbook has been improved and standardized.

Size Separation of Powders.—From the apparatus for the quantitative separation of very fine sizes of powders, equipment has been developed for effecting accurate particle size cuts beginning at about 3 microns. The capacity is roughly proportional to air flow and about 600 cm^3 of material is originally charged.

Development of Methods for Formation of Vitrified Magnesia Crucibles.—Vitrified magnesia crucibles of laboratory size have been prepared by a novel method of forming under high pressure. They are fired to 2,800° C. in a high-frequency furnace. The crucibles have a chinawarelike translucence and are impervious to fluids under pressure.

Reducibility of Iron Ores.—The Bureau of Mines is conducting an investigation for the establishment of a standard method of determining and expressing the reducibility of iron ores, so that furnace operation may be more easily controlled.

Uniform Mine-Accident Statistics.—The bureau participates in the general movement in the United States to prepare accident statistics for all industries on a comparable basis. During the past year it was represented on the subcommittee on definitions of the committee on industrial accident statistics, which is allied with the American Standards Association.

Standard Code for Classifying Mine Accidents.—A standard classification of the causes and severity of mine accidents and the principal facts concerning the accidents and the injured employees is essential to efficient studies of methods of accident prevention. Such a standard classification has been provided in a code prepared by the bureau for the classification of facts relating to accidents at coal mines and metal mines.

Standard Code for Classifying Quarry Accidents.—A tentative standard code has been prepared by the bureau for classifying the principal circumstances relating to accidents at stone quarries and at crushers, cement mills, and other plants frequently operated in connection with quarries.

Terminology of Silicosis.—In an endeavor to further uniformity of terms regarding silicosis for the use of the industrial physician, health officers, and compensation boards it is suggested that silicosis be defined as a form of pneumoconiosis due to breathing air containing silica dust, characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness of breath, decreased lung expansion, lessened capacity for work, increased susceptibility to tuberculosis, and characteristic X-ray findings.

For convenience of description the disease has been divided arbitrarily into first, second, and third stages. The radiographic findings are indicated as (1) normal thorax, (2) slight increase in linear radiation, and (3) moderate increase in linear radiation considered within normal limits. The earliest specific radiographic indi-

cation of the presence of silicosis is defined as a "generalized arborization throughout both lung fields with a partial small characteristic mottling."

Method of Test for Water Absorption of Slate.—The Bureau of Mines worked in close cooperation with Committee D–16 on Slate of the American Society for Testing Materials in perfecting tentative standard D 221–27 T, and advancing it as a permanent standard.

Tentative Methods of Flexure Testing of Slate.—Much cooperative work was done with Committee D–16 on Slate of the American Society for Testing Materials in perfecting methods of testing for modulus of rupture and modulus of elasticity of slate. As a result of this work tentative standard D 222–27 T was advanced to a permanent standard.

Establishment of a Tentative Standard for Roofing Slate.—The committee on brick and building tile of the Federal Specifications Board has undertaken the task of formulating a standard specification for roofing slate to be used in Government departments. A representative of the Bureau of Mines was one of a subcommittee of three who framed the specification and revised it several times as a result of conferences with both producers and users. The standard has been issued in tentative form.

BUREAU OF NAVIGATION

This bureau has been continuing its efforts toward the standardization of its forms in the departmental as well as in its field services.

BUREAU OF STANDARDS

For standardization activities of the Bureau of Standards see page 194 of Section VI.

COAST AND GEODETIC SURVEY

The Coast and Geodetic Survey has paid particular attention to the standardization of its equipment, in so far as feasible, with particular emphasis on the adoption of such standard commercial instruments as may be available and in the use of the same elements on different instruments of similar character. Progress was also made in standardizing tide and current instruments and in the methods used in reducing tide and current observations.

Other Government agencies were cooperated with in the preparation of specifications for the purchase of instrumental equipment; these specifications to be as nearly as possible of a standard character, that they may be used in whole or part in subsequent purchases.

Magnetic work is standardized in cooperation with the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, and the International Meteorological Committee of the Commission on Terrestrial Magnetism and Atmospheric Electricity.

Representatives of the Coast and Geodetic Survey continued active on the Federal Specifications Board, and the Federal Board of Surveys and Maps, in cartographic matters. Alaskan names were corrected, and revised descriptions prepared for the United States Board of Geographic Names.

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The Coast and Geodetic Survey is charged by law with the establishment over the area of the United States of networks of triangulation and leveling, designed to supply the geographic positions of triangulation stations and the elevations of bench marks, for use in many branches of industry. The triangulation and leveling involved are generally called control surveys, for they control and standardize the elevations and positions of detailed surveys and of various classes of maps. A recent adjustment has made available thousands of additional points in this country with standard geographic positions (that is, latitudes and longitudes) and standard elevations.

It is reasonably certain that the triangulation and leveling nets of the country will be rapidly augmented by other agencies of the Federal and State Governments, counties, and cities, and by private engineers. These two nets form a sort of basis or framework to which surveying and mapping of a local or detailed nature can be tied and standardized, thus giving proper dimensions and forms to maps needed for local purposes.

STEAMBOAT INSPECTION SERVICE

A tentative draft of a boiler code was completed in 1931, but it was deemed desirable to rearrange the subjects covered and change in some respects the provisions thereof. A special committee representing the various interests is now working upon the matter and it is anticipated that this work will be completed, so as to be finally acted upon, during the session of the board commencing in January, 1932.

It has also been deemed desirable to revise the remainder of the rules of the board of supervising inspectors covering life-saving and fire-fighting equipment, etc., and a special committee composed of the various interests is now working upon these revisions of the rules, and it is hoped that the work will also be completed so as to have attention within the near future.

DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

This bureau is represented on one technical committee of the Federal Specifications Board.

Standardization work that has been approved since August 1, 1930, and now being used by the Bureau of Reclamation includes the following:

84-inch internal differential needle valve.
5 feet 8 inches by 10 feet high-pressure hydraulic-operated sluice gates.
No. 2 automatic hydraulic gate hanger, capacity 40,000 pounds.
132-inch emergency butterfly valve with mechanically operated gear.
18 feet diameter by 6 feet high tandem structural steel cylinder gate with tandem-cylinder gate hoist.
4.8 feet by 6.0 feet cast-iron shear gate, spigot frame.
Hollow metal single door.
Stadia board.
Resistance thermometer.
Typical installation of resistance thermometers.
Drum-gate seals for lower lip and upstream face.
Pop valve for salt-brine velocity tests.
Bevel spur-gear reduction transmission.
Gate height indicator.

Standardization work done in this bureau in the past, now in progress, and contemplated in the future, is limited to the development of designs and practices to be adopted as standards by this bureau only, for use in connection with the Federal irrigation projects in the West. In this the interests of this bureau are the controlling factors, and cooperation with outside interests in the matter has been largely incidental. Standard designs have been prepared and are now in use for about 35 groups and classes of machinery and structures, including about 650 drawings.

A revised list of publications (No. 8) has been issued containing a list of many of the standard and special designs issued.

FREEDMEN'S HOSPITAL

Commodities used in this hospital not covered by the Federal specifications, such as foods, are required to conform to the standards set up by the Bureau of Agricultural Economics, Department of Agriculture.

In its hospital activities, Freedmen's Hospital has cooperated with the American College of Surgeons, American Medical Association, and various nursing boards in the matter of advancing the minimum standards.

GEOLOGICAL SURVEY

The Geological Survey, in cooperation with other Federal map-making agencies, is continuing the standardization of map symbols and practices through the Federal Board of Surveys and Maps of which it is a member organization.

It is also continuing the standardization of its field equipment, particularly its field instruments, with a view to obtaining the most effective design of wear-resisting materials and interchangeable parts. It is expected that this will facilitate repairs both in the field and in the shop and will materially reduce costs.

The Geological Survey has sponsorship of a sectional committee of the American Standards Association which is endeavoring to standardize bases for computing and units for expressing water-power resources for statistical use. Various governmental agencies are represented on this committee.

Representatives of this bureau are serving as members of several committees of the Federal Specifications Board.

NATIONAL PARK SERVICE

The plan for standardizing certain specifications for purchase of equipment and supplies as reported in the Standards Yearbook, 1931, has been continued for the current year along the lines indicated in the previous report.

During the past year, actual standardized specifications have been completed for the following:

Tractors, 10 to 60 horsepower.
Air compressors for trail purposes.
Power drag saws.
Power snow plows of the rotary type.
Blade graders, from 1,500 to 11,000 pounds.
Motor cycles, police type.

Oil distributors for trail use, mounted on 20 horsepower tractor with 3 to 5 feet distributing bar.
Truck road-oil tanks, 800 and 1,000 gallon capacity.
Dynamite, various grades.
Portable gasoline fire pumps.
Fire hose.
Air hose.
Khaki and white canvas tents.
Folding steel camp cots.
Camp-cot pads and slip covers.
Power shovels, ⅜ to 1 cubic yard.
Low-bed trailers for transportation of shovels.
Road oil of various consistencies.
Emulsified asphalt of various consistencies.
Sewage disposal plant.
Deisel engines, 120 horsepower, 90 kilovolt-ampere.
Passenger automobiles, 4-cylinder sedans to 8-cylinder sedans.
Motor trucks, ¼, ¾, 1, 1½, 2, 3, and 5 ton, with various equipment.

Further standardization work has been done on machinery and equipment specifications which are common to all machinery and equipment, which express more clearly the conditions under which equipment will operate in the National Parks, and which conform also more closely to the requirements of the Comptroller General in describing the "job to be done."

Wherever applicable and possible Federal Specifications are used, and Simplified Practice Recommendations are followed.

The work of further standardizing other specifications will be continued during the coming months, and revisions will be made of existing specifications for motor-driven equipment as rapidly as data on the new models is received.

OFFICE OF INDIAN AFFAIRS

The Indian Service, during the year, was required to purchase under special appropriations a large number of items of equipment which it had previously procured from time to time as needed, under specifications which were inadequate and which did not set forth properly the needs of the service.

In order to insure the purchase of equipment which would meet their needs and at the same time safeguard the inexperienced students in their schools who are required to assist in culinary, laundry, and other departments it became necessary to prepare suitable specifications for use in advertising for vegetable-paring machines, food choppers, dough mixers, bread and cake mixers, combination dish and food trucks, steam-jacketed kettles, portable bake ovens, dish-washing machines, and kitchen ranges. In order to meet their requirements it was necessary to make specifications elastic enough to meet the individual needs of both small and large institutions. The reports so far received from field superintendents indicate that the specifications used resulted in the purchase of equipment which has been entirely satisfactory.

It is the intention of this office to promulgate these specifications as standard for use in the Indian Service. The Indian Service has, during the year, promulgated standard specifications for the use of the field service in advertising for pure bred, registered, and grade dairy cattle.

A specification has been developed for use in advertising for the large type of X-ray machines. Specifications for aluminum ware were improved upon during the past year. The matter of standardizing on hospital equipment, such as operating tables, sterilizers, etc., is now receiving attention.

Representatives of this office have taken an active part in the revision of Federal specifications for laundry machinery, as the result of which greater competition has been had and lower prices received.

ST. ELIZABETHS HOSPITAL

St. Elizabeths Hospital cooperates with the Federal Specifications Board in the standardization of specifications, with the National Committee on Mental Hygiene in classifying the hospital records and statistics, and reports covering the mentally ill. The hospital also cooperates with this same committee and with the American Medical Association and surgeons and physicians in standardizing all records and classifying diseases.

DEPARTMENT OF LABOR

BUREAU OF LABOR STATISTICS

The Commissioner of Labor Statistics represents the Department of Labor on the council of the American Standards Association. The Bureau of Labor Statistics is represented on the safety code correlating committee of the American Standards Association, and by arrangement with this association the workers' representatives on safety code committees on the advice of the bureau are selected and appointed through the Department of Labor.

Practically all of the American Standards Association codes which deal with safety of workers are published by the Bureau of Labor Statistics. One of these codes was published by the bureau during the past year as Bulletin No. 527, Safety Code for the Use, Care, and Protection of Abrasive Wheels.

The Commissioner of Labor Statistics is secretary-treasurer of the International Association of Industrial Accident Boards and Commissions, and appoints the representatives of that association on the American Standards Association Safety Code Correlating Committee and the various safety code sectional committees.

In its report on productivity and longshore labor conditions in the principal ports of the United States, published during the year, the bureau emphasizes the need for the adoption of a uniform standard of cargo measurement to be applied to all ports, a universal safety code for longshore operations, and a gradual decasualization of the water front in order to mitigate the hardships of unemployment and underemployment which are inherent in this most casual of all industries.

The bureau in association with the various State bureaus of labor statistics seeks to promote the standardization of methods of collection and tabulation of statistics.

CHILDREN'S BUREAU

During the year the Children's Bureau has carried on the following activities relating especially to the development of standards:

Collecting on a uniform schedule and compiling reports on employment certificates issued to working children in various States and cities. For the calendar year 1931 such information was obtained from the District of Columbia, 23 States, and 40 cities in 11 other States.

Collecting and compiling information concerning juvenile-court cases of delinquency, dependency, and neglect. Progress is being made in the development of States reporting on a uniform basis. Under this plan most of the courts will report through the State department of welfare, only the larger courts reporting direct to the bureau.

Collecting and compiling, according to a uniform plan, current statistics in child welfare and related fields. Monthly reports are received from 1,817 social agencies in 39 cities.

Participation in developing standards in various fields of child welfare as part of the work of the White House Conference on Child Health and Protection. Members of the bureau staff took part in the work of the following committees: Committee on delinquency, public-health organization, committee on State and local organization for the handicapped, committee on growth and development, committee on medical care for children, committee on prenatal and maternal care, committee on vocational guidance and child labor.

WOMEN'S BUREAU

The act creating the Womens' Bureau charges it with the duty "to formulate standards and policies which shall promote the welfare of wage-earning women, improve their working conditions, increase their efficiency, and advance their opportunities for profitable employment." In pursuance of the purposes of this charge, the Women's Bureau has recommended certain minimum standards for places employing women, including those relating to hours of labor, wages, comfort and sanitation, posture and physical strain at work, safety and health, and home. These standards were described in the Standards Yearbook, 1931. The following additional items have been covered since that yearbook was issued:

Employment Management.—Maintenance of an adequate personnel department and appointment of women as executives and supervisors where women are employed.

Workers' Cooperation.—Full representation of women, in proportion to their numbers, in the organization necessary for collective bargaining.

Cooperation with Official Agencies.—The general and effective use of official State and Federal agencies for information and assistance regarding the employment of women.

Since the publication of the yearbook, the Women's Bureau has prepared handbooks amplifying three of the foregoing subjects, as follows:

Industrial Accidents.—Collecting such statistics on this subject as the various States have published by sex, and recommending the adoption by all States of separation of accident reports by sex, with significant correlations by sex, and the use for this purpose of the standard form recommended by the International Association of Industrial Accident Boards and Commissions.

Drinking Facilities in Places of Employment.—Collecting such sanitary standards as States have provided on this subject and recommending for places of employment standards for drinking water service, including those on essential features in the design of drinking fountains adopted by the American Public Health Association and the Conference of State Sanitary Engineers.

Toilet Facilities in Places of Employment.—Collecting and presenting in uniform categories State sanitary regulations on this subject, recommending the application of the most specific available standards, and thus contributing to the development of more acceptable standards along this line.

In addition to the foregoing activities recommending standards, either the Director or the Assistant Director of the Bureau has served on committees or in an official capacity in numerous organizations and groups whose programs or work touch the matter of adequate standards relating to the employment of women.

NAVY DEPARTMENT

BUREAU OF AERONAUTICS

The Bureau of Aeronautics and the Army Air Corps are continuing their program of standardization. Originally intended to cover only a few of the more important materials used in the construction of aircraft, their scope has gradually expanded to include articles of equipment, instruments, fittings, power plant parts and finishing materials, as well as processes of manufacture and design requirements. The extent to which this standardization has grown may be noted from a comparison of the attendance at the first Army-Navy Standards Conference, held in 1924, at which 13 people were present, and the most recent conference at which approximately 200 were present.

While this standardization was primarily intended for the advancement of aeronautics in the military branches of the Government, each standard is considered not only on the basis of its military value, but with a view toward its adaptibility to commercial aeronautics and the related industries concerned. It is believed that the increasing interest is directly traceable to this fundamental principle which is observed in every case.

The standardization of an item does not serve to stop further development. A preliminary conference, attended only by representatives of the Bureau of Aeronautics and the Army Air Corps, is held annually, at which time the needs of the services are discussed, and proposed standards and the necessity of revising existing standards are decided upon. These subjects are divided between the two services, the branch most intimately connected with the problem being delegated to investigate the improved materials or methods and to prepare the necessary specifications or revisions. Copies are submitted to interested manufacturers with an invitation to be present at the annual general conference and submit their comments and discuss the various standards proposed. Bringing into conference the experts who specialize in the manufacture of these materials tend to make available the highest grade and most suitable type of products to the mutual benefit of all concerned—the industries supplying materials and manufacturing aircraft as well as the users.

The following is a partial list of Army-Navy Standards or master specifications which have been prepared or are now in process of preparation:

Aircraft:
- Instructions for airplane designers.
- Acceptance test of engines.
- Acceptance test of engine spark plugs.
- Standard engine nomenclature.
- Weight forms.
- Engine type test.
- Rib test loads.
- Spacing of rib lacing.
- Coating airplanes.
- Propellers—blades, hubs, and clamp rings.
- Landing wheels.
- Airplane tires and tubes.
- Airplane fuel
- Engine lubricating oil.

Metals:
- General specification for aluminum alloy steels.

Instruments:
- Altimeters.
- Airspeed meters.
- Clocks.
- Compasses.
- Gages.
- Inclinometers.
- Fuel pumps.
- Starters.
- Tachometers.
- Thermometers.
- Thermocouples.

Electrical:
- Aircraft batteries.
- Cables.
- Generators.
- Sealing compound for batteries.
- Conduit and conduit fittings.
- Bonding and engine shielding.

Fittings:
- Bolts and nuts.
- Pins.
- Screws.
- Control cables.
- Control pulleys.
- Hose clamps.
- Fuel cocks.
- Cowl fasteners.
- Bushings.
- Ball joints.
- Universal joints.
- Shackles.
- Terminals.
- Tie rods.
- Tubes and tubing.
- Turnbuckles.
- Washers.
- Pipe-thread tolerances.

Lumber:
- Ash.
- Spruce.
- Wood for propellers.
- Kiln-drying process.
- Plywood.
- Determination of moisture content.

Textiles:
- General specifications for testing—
  - Airplane and balloon fabrics.
  - Parachute silk.
  - Silk cordage.
  - Thread, cotton and linen.
  - Linen webbing.
  - Wool belt.
  - Clothing, jackets, suits, helmets, shoes, gloves.

Finishes:
- Aircraft dopes.
- Dope-proof paint.
- Varnish.
- Bituminous paint.
- Glue, casein and marine.

The Bureau of Aeronautics is particularly active in research and development of aircraft materials, and in this connection cooperates closely with the American Standards Association, American Society for Testing Materials, Federal Specifications Board, National Advisory Committee for Aeronautics, and the Society of Automotive Engineers.

BUREAU OF CONSTRUCTION AND REPAIR

In maintaining contact and cooperating with various Federal departments and industrial organizations, this bureau holds membership as follows:

Federal Specifications Board: 38 committees and 15 subcommittees.

American Standards Association: The council, the committee on procedure, and 15 sectional committees.

American Society for Testing Materials: 12 committees and 24 subcommittees.

Committee on Commodities, Federal Purchasing Board: 1 subcommittee and 12 advisory groups.

American Marine Standards Committee: Executive board and 12 technical committees.
The flag standardization committee of the Division of Simplified Practice.

In addition to its participation as a member in the activities of the above organizations the bureau is vitally interested in and cooperates with the following:

Division of simplified practice, Bureau of Standards.
National Screw Thread Commission.
National Lumber Manufacturers Association.
Hemp Brokers Association.
Cordage Institute.
Fine Arts Commission.
American Welding Society.

With a view to the benefits to be gained by national standardization, this bureau endeavors to adopt nationally approved standards in all cases except those specifically covered by military requirements. Wherever possible, considerable assistance is given by the bureau's technical personnel to the evolution of new standards and to the revision of existing standards.

In keeping with its continued interest in practical and laboratory research, the bureau officially authorized during the past fiscal year 159 new tests and completed 146 tests previously authorized, the records of which are filed and indexed for future reference.

During the past fiscal year, 8 new Navy specifications have been issued, 31 specifications revised, and 172 Federal specifications passed upon.

Outstanding research projects in which considerable progress has been made during the fiscal year in the improvement of materials include the following:

Bullet-proof steel.
Welding of high-tensile steel.
Welding of corrosion-resisting steel.
Metallic brown paint for boiler feed water tanks.
Rubber gaskets.
Gasoline hose.
Nonscatterable glass.
Cleaning compounds (for tanks).
Aluminum-foil insulation.
Refrigerators (for shipboard).
Screen cloth (corrosion-resisting steel).
Gasoline stowage tanks of corrosion resisting steel.

Projects which show promise of yielding valuable data include the following:

Wire-rope corrosion tests.
Rivet-corrosion tests.
Cadmium-coating exposure tests.
Cleaning compounds (performance factors).
Innerspring mattresses (service test).
Pipe-corrosion tests.
Tests of high-tensile rivets.
Manila rope durability tests.
Tests of mercerized-cotton bunting.
Ship bottom paint-service tests.
Aluminum paint-service tests.
Investigation of marine glue.
Corrosion-resisting steel for washbowls, basins, etc.
Corrosion-resisting steel for soda-lime containers.

Tests of high-elastic limit steel-hull plates adaptable to welding.
Tests of welding electrodes of various manufacturers.
Tests of nickel-clad steel plates.

BUREAU OF ENGINEERING

The bureau maintains its relations with other Federal departments and with industry in general as to standardization and specification formulation and revision through the medium of the following technical societies and committees:

Federal Specifications Board: 16 committees.
American Standards Association: Council and 25 sectional committees.
American Society for Testing Materials: 21 committees and 34 subcommittees.
American Society of Mechanical Engineers: 1 committee and committees associated with American Standards Association.
American Marine Standards Committee: Executive board and 13 committees.
National Screw Thread Commission.
American Institute of Electrical Engineers: 1 subcommittee.
American National Committee of the International Electrotechnical Commission.
Federal Purchasing Board: 1 subcommittee.
National Research Council: 1 subcommittee.
Society of Automotive Engineers: 2 sectional committees.
National Industrial Conference Board's Advisory Committee on the Fuel Oil Situation.
Advisory Committee on Nonferrous Metals of the Bureau of Standards.

During the past year the bureau has investigated, in laboratories under its control, a very considerable number of different types of apparatus, materials, and processes, with a view to selecting the best available in the commercial field for standardization, methods of employment, and for the preparation of adequate specifications. In some cases investigation has just been inaugurated. Typical examples are as follows:

Motors and controllers, alternating current.
Generators, alternating current.
Phenolic insulation, molded and laminated.
Circuit breakers.
Switches for dead-front panels.
Electrical-measuring instruments for shipboard use.
Electric cable for shipboard use.
Electrical equipment for metal arc welding.
Carbon-brush material.
Incandescent-electric lamps for shipboard use.
Electrical-insulating material (solid and liquid).
Electrical-machinery temperature gradients.
Dry batteries.
Portable lead-acid batteries.
Electric heaters, air, for shipboard use.
Cotton sleeving insulating material.
Asbestos, linen, and silk insulating tape.
Commutator-conditioning devices.
Portable electric drills.
Motors and controllers, direct current.
Insulating varnish.
Portable electric-ventilating sets (explosion-proof type).
Sound motion-picture projectors for shipboard use.
Electric telegraphs (alternating current) for shipboard use.
Sound pick-up devices for underwater signaling.
Echo-sounding equipment.
Storage-battery testing outfits.

Radio high-frequency receivers and transmitters.
Radio-wave propagation.
Materials having piezo-electric effect.
Instruments for measuring high frequencies.
Radio traps.
Equipment for the transmission of photographs.
Equipment for writing maps and sketches.
Equipment for measuring airplane and submarine antenna constants.
Radio-indicating meters.
Resistance and resistors for naval radio equipment.
Condensers (radio).
Vacuum tubes for naval radio equipment.
Transmission ranges of radio-frequency.
Aircraft radio installations.
Fireroom draft gages.
Water meters.
Fuel-oil meters.
Pump governors.
Temperature regulators.
Tachometers, chronometer, and centrifugal types.
Steam traps.
Pressure reducing valves.
Ball bearings.
Apparatus for testing ball bearings.
Bolts, nuts, and screws.
Taps and dies.
Miscellaneous valves for shipboard use.
Heat-insulating materials for use with temperatures above 1,500° F.
Heat-insulating materials for low temperatures.
Antogenous welding with fabrication of engineering apparatus.
Copper-nickel alloy condenser tubes.
Boiler feed-water treatment.
Corrosion fatigue of metals.
Gasket material.
Packing.
Tool steel.
Cutting oils.
Lubricating oils.
Boiler refractories:
- Fire-clay brick.
- Fire-clay dust.
- Plastic fire-brick material.
- High-temperature cement.

Spark plugs.
Grinding compounds.
Gage glasses and fittings.
Brushes for motor-driven boiler-tube cleaning outfits.
Shafts for motor-driven boiler-tube cleaning outfits.
Fuel oil.
Diesel fuel oil.
Strength of materials at elevated temperatures.
Diesel engines for motor boats.
Aluminum foil as a heat-insulating material.
Steel-casting technique.
Mineral wool for heat insulation.
Surface treatment of distiller tubes, superheater tubes, and boiler feed-water tanks.
Tank gages.
Storage batteries, reduction in water consumption.
Storage-battery explosion, investigation of causes.
Storage-battery ventilation, hydrogen detector.

BUREAU OF MEDICINE AND SURGERY

The Bureau of Medicine and Surgery is represented on various technical committees of the Federal Specification Board, and

through this representation has taken an active part in the plans and specifications for the standardization particularly of hospital supplies, equipment, drugs, and medicines.

The Naval Medical Supply Depot at Brooklyn, N. Y., is equipped with chemical, physical, and X-ray laboratories for testing material purchased for the medical department of the Navy and for investigations in connection with the formulation of specifications. The materials tested include drugs, chemicals, rubber goods, hospital and surgical textiles, surgical instruments, clinical instruments of precision, and X-ray apparatus and supplies. These laboratories also test drugs, chemicals, surgical dressings, and rubber sundries purchased for the Veterans' Administration. Chemical glassware for the Veterans' Administration is also calibrated by these laboratories. A number of tests and inspections have also been conducted for the Department of Interior and the Guardia Nacional de Nicaragua.

During the past fiscal year 18 proposed revisions of Federal specifications have been reviewed. At the present time approximately 50 Federal specifications, or specifications complying with all the technical requirements of the Federal specifications, are used by this supply depot, and Federal specifications for testing material and for packing are utilized to the fullest extent. The Naval Medical Supply Depot in Brooklyn has found that the trade is becoming more familiar with Federal specifications and that very satisfactory material is obtained in accordance with these requirements.

BUREAU OF NAVIGATION

The Naval Observatory under the jurisdiction of this bureau is the source of standard time in the United States. This observatory has representation on the National Committee on Calendar Simplification and on several international commissions of the International Astronomical Union.

The Hydrographic Office of this bureau works on specialized standardization between other branches of the Government. This office maintains membership on the Board of Surveys and Maps for the purpose of coordination and standardization of its chart and map construction. This office is represented on the United States Geographic Board, and cooperates with foreign hydrographic services. The United States is represented on the International Hydrographic Bureau.

The efforts of the Bureau of Navigation are directed toward the standardization of forms, symbols, characters, and methods of surveying, chart construction for navigation and aviation charts, and the publication of nautical books.

BUREAU OF ORDNANCE

The Bureau of Ordnance, in common with other bureaus of the Navy Department, has continued its efforts toward standardization of specifications and practice. The desirability of standardization was long since recognized, and resulted in the organization of a departmental board, of which this bureau was a member, for the consideration and compilation of specifications for the Navy Department as a whole. This board in the past has done a notable work,

as evidenced by the extensive and truly valuable body of Navy Department specifications which it was instrumental in developing and assembling. Nor have its activities and value in this field ceased with the coming of the Federal Specifications Board, of broader scope than was the departmental board. On the contrary, the Navy Department specification board is still actively engaged in scrutinizing and revising, as necessary, department specifications now in existence, drawing up new specifications conforming with the needs of the various bureaus, and correlating department specifications with those promulgated from time to time by the Federal Specifications Board.

Besides being a member of the Navy Department specification board, the Bureau of Ordnance holds membership in several technical committees of the Federal Specifications Board, and is, in addition, a member of the National Screw Thread Commission and the American Standards Association. It is thus in a position, of which it avails itself, to take an active part in specification making and standardization.

By virtue of its various ordnance plants, such as the Naval Gun Factory, the Naval Powder Factory, the Naval Torpedo Station, Newport, R. I., and the Naval Ordnance Plant, Baldwin, L. I., the Bureau of Ordnance is a large manufacturing concern. The items of ordnance material which it manufactures are designed by engineers and design personnel within the bureau and the plants concerned. At present there are on file considerably more than 200,000 ordnance drawings and sketches, furnishing information necessary for manufacturing purposes. As exemplified by Bureau of Ordnance practice, this information includes not only specifications for material, indicated in accordance with Navy Department numbers or symbols, but also dimensions, fits, tolerances, finishes, etc., shown in accordance with a system that has been standard in the bureau for a great many years.

As Federal specifications are promulgated, immediate steps are taken to bring this bureau's specification requirements in conformance therewith. In order not to render existing ordnance drawings valueless, however, it is apparent that means must be provided for identifying Navy Department specification numbers, which these drawings bear, with the corresponding Federal specification numbers that supersede them. This was a matter of serious concern to the bureau; for it was obviously impossible, with the limited drafting forces available, to undertake, in addition to current work, a wholesale revision of drawings already in existence. With the cooperation of the Federal Specifications Board, permission was obtained to print Federal specifications in leaflet form, each bearing, in addition to the Federal specification number, the old Navy specification number or symbol to which it corresponds, or from which it is taken. This furnishes a cross-reference between Federal and Navy specifications, and serves immediately to connect ordnance drawings with the Federal specifications which properly apply to them.

In any change from one standard to another, it is inevitable that problems will arise during the period of transition. As in the case of the cross-referencing of Federal and Navy Department specifi-

cations, however, it is confidently expected that a satisfactory solution for these problems will be found.

BUREAUS OF SUPPLIES AND ACCOUNTS

During the year the Bureau of Supplies and Accounts issued 38 new and revised 98 old Navy Department specifications. None of these new specifications are based on Federal specifications. In addition to the above, four issues of the Index to Specifications were made, and a revision of Appendix IV to General Specifications for Inspection of Material.

Work of drawing up standard specifications for provisions and clothing is being continued.

BUREAU OF YARDS AND DOCKS

Members of this bureau represent the Navy Department on 22 technical committees of the Federal Specifications Board.

The bureau is also represented on the committee on commodities of the Federal Purchasing Board, and has membership on committees of the Navy Department specification board, American Standards Association, and American Society for Testing Materials.

The bureau is conducting the following research investigations:

Experiments to establish standards for concrete in sea water at the navy yard, Portsmouth, N. H.

Service tests on copper-bearing steel-sheet piles, and electroplated reinforcing bars, at the naval station, Key West, Fla.

Long-time endurance tests of galvanized materials at the naval station, Key West, Fla.

Field tests of treated timber in connection with protection against termites.

Wear test of carpets and rugs.

The bureau is also cooperating with the Chemical Warfare Service on field tests of preservatives for timber and marine piling and is contributing funds for this work.

OFFICE OF THE SECRETARY

The Navy Department specifications board standardizes the form for Navy Department specifications as far as practicable; unifies specifications for material used in common by two or more bureaus and expedites action on all matters relating to the issue or reissue of Navy Department specifications.

The board consists of officers and technical assistants of various bureaus of the Navy Department, with the technical aide to the secretary as senior member. The board cooperates closely with the Navy Department's member of the Federal Specifications Board.

This office also handles all matters received from the division of simplified practice of the Bureau of Standards.

UNITED STATES MARINE CORPS

The Marine Corps is employing Federal specifications in all purchases where such specifications apply, and Marine Corps specifications are revised to conform with Federal specifications where such revision is necessary. Officers of the Quartermaster's Department, Marine Corps, are representatives on nine technical committees of

the Federal Specifications Board. One officer of the Marine Corps is detailed to full-time duty with the Federal Specifications Board, and considerable time is devoted to the Standard Stock Catalogue by the Office of the Quartermaster.

POST OFFICE DEPARTMENT

FOURTH ASSISTANT POSTMASTER GENERAL

The standardized handling of letter mail on the unit basis has been adopted and is now on the plans for many of the proposed Government buildings for post offices. This standardized unit consists of the assembling of furniture in the post office and the mechanical equipment operated by 26 employees, with an approximate hourly output of 32,000 letters. The number of units in the post office will, of course, be determined by the volume of mail in that particular office. For instance, in the new post office at Chicago, Ill., where the usual daily output of letter mail is 6,500,000 pieces, 38 units will be installed. The number of units in operation during any given hour of the day is determined by the volume of mail. The unit system brings the mail under the absolute control of the management with the assurance that the mail will be handled during the hour in which it arrives at the office.

With the assistance of the Bureau of Standards, and after service tests demonstrated their greater durability, specifications have been prepared for steel-framed platform trucks to be used in the Postal Service.

Reports have reached the department that many letter-box time cards have been defaced and rendered unserviceable. Experiments are being conducted with transparent sheets which are placed in front of the cards. These experiments are being carried on to determine whether their use will prolong the legibility and life of the cards.

A holder for money-order application blanks for use on lobby desks has been adopted. More than 7,500 have been purchased and distributed throughout the country to post offices of the first and second classes. This holder was adopted in order to conserve the supply of money-order application blanks and to keep them in an orderly manner.

The department has discontinued supplying the combination letter and package box and the package box for the deposit of mail matter. This has been done for the express purpose of conserving the time of collectors and reducing the number of large packages mailed in boxes of this type. A large collection box, with one compartment only, will be supplied in lieu of the boxes mentioned. The large collection box is similar to the package box, with the exception that the words "U. S. Mail" are embossed on the drop cover instead of the word "Packages."

Specifications were recently promulgated covering an unfinished-cotton wrapping twine, which the Bureau of Standards worked out for this department, as a substitute for the single-ply jute twine; also specifications covering comparable cotton twines to compete with the heavier jute twines heretofore used in the Postal Service.

SECOND ASSISTANT POSTMASTER GENERAL

Substantial progress was made in standardizing and improving railway post-office cars during the fiscal year ending June 30, 1931. Thirty-six cars were brought up to standard specifications, 25 cars were strengthened in construction features, 289 cars were equipped with sanitary fixtures, 130 cars were supplied with electric fans, and 106 were equipped with electric lamps, in lieu of gas or oil lamps.

During the year 74 new standard all-steel railway post-office cars were built and placed in service. On June 30, 1931, 12 additional all-steel railway post-office cars were under construction. At the end of the fiscal year all of the full railway post-office cars and 66 per cent of the mail apartment cars in actual service were of standard all-steel construction and practically all of the other mail apartment cars were steel underframe or wood steel-reinforced construction. The number of wood mail apartment cars at the end of the year was 19 and most of these were being held in reserve for emergency use only.

The work of standardizing quarters occupied by terminal railway post office located at or in railroad stations was continued during the year, and consideration is being given to providing for these activities in Federal buildings, to be located at or near railroad stations, where such buildings are either under construction or being contemplated.

THIRD ASSISTANT POSTMASTER GENERAL

Further definite steps were taken during the last year to standardize stamped envelopes to more nearly conform to commercial practices. Arrangements were made on January 1, 1931, to discontinue the manufacture of the "low-back" pattern stamped envelope and have standard quality envelopes manufactured after that date exclusively in the commercial standard or "high-back" style. This change reduces the number of varieties of stamped envelopes required to be kept on sale in post offices, besides effecting a substantial saving in the cost of manufacture and distribution.

TREASURY DEPARTMENT

COAST GUARD

The Coast Guard is continuing to develop the possibilities of standardization in its specifications and in the construction of vessels, boats, and buildings. The standards sponsored by the Federal Specifications Board and the American Marine Standards Committee are being utilized to the utmost, and the publications of these agencies are consistently brought to the attention of concerns who supply material for the service. This service is represented on several technical committees of the Federal Specifications Board.

OFFICE OF SUPERVISING ARCHITECT

This office has continued the standardization of miscellaneous detail drawings, which are taken up from time to time and now covers approximately 170 details; and the use so far as practicable of type

plans and specifications for Federal buildings based on certain standardized arrangements to meet typical conditions.

The office has representatives on several technical committees of the Federal Specifications Board.

PUBLIC HEALTH SERVICE

Official standards or official tests of the National Institute of Health include diphtheria antitoxin, scarlet-fever streptococcus antitoxin, tetanus antitoxin, botulinus antitoxin, perfringens antitoxin, antidysenteric serum, antimeningococcic serum, antipneumococcic serum; bacterial vaccines made from typhoid bacillus, paratyphoid bacillus A, paratyphoid bacillus B; diphtheria toxin-antitoxin mixture, diphtheria toxoid, diphtheria toxin for Schick test, scarlet-fever streptococcus toxin for Dick test, scarlet-fever streptococcus toxin for immunization, and arsphenamine and its derivatives.

Through its section of industrial hygiene and sanitation the Public Health Service is assisting the New York State department of labor in preparing regulations for rock drilling, sandblasting, and rock crushing.

Officers of the industrial hygiene section represent the Public Health Service on the Safety Code Correlating Committee of the American Standards Association and on 8 A. S. A. sectional committees.

The Public Health Service is represented on the Sandblast Committee of the National Safety Council and has been actively engaged in field work on sandblasting in cooperation with the National Safety Council. The final report on this work will assist in providing a basis for the standardization of protection methods for this industrial process in so far as that may be practicable.

Representatives of the Public Heealth Service are serving on a number of committees of the Federal Specifications Board.

The Public Health Service is also represented on the joint committee of the American Railway Association, the American Standards Association, the American Marine Standards Committee, and various committees having to do with standards and methods of the American Public Health Association, the American Waterworks Association, and the Conference of State Sanitary Engineers.

The Public Health Service has for seven years been encouraging the standardization of milk-sanitation control in the United States through the passage and enforcement by American cities of a standard milk ordinance. During the past year more than 50 communities have enacted the ordinance, bringing the total number of American communities in which the standard ordinance is in effect to about 435. Additional impetus has been given to this standardization work by the fact that there will be published shortly a revised edition of the milk ordinance and code recommended by the Public Health Service, which will carry also the recommendation of the Bureau of Dairy Industry of the United States Department of Agriculture.

For several years the United States Public Health Service has been developing the principles and technique of effective rat proofing of vessels. This work has been placed upon such a firm basis that the

details and specifications are now standardized. These specifications have also been adopted and promulgated by the American Marine Standards Committee as Marine Standard No. H–41, the observation of which is mandatory for construction of new ships with Government loan aid. A recent publication issued by the United States Public Health Service dealing with the rat proofing of vessels, contains illustrations and drawings, together with general instructions for the rat proofing of ships.

The standards for drinking and culinary water supplied by common carriers in interstate traffic and adopted in 1925 are still in force.

Minimum requirements upon which the Public Health Service bases its approval of the sanitary control over the shellfish industry by the several States remains as before.

The essential features in the design of sanitary drinking fountains as recommended by the American Public Health Association and the Conference of State Sanitary Engineers has been adopted by the Treasury Department.

The Public Health Service has suggested to State health officers a proposed plan for a morbidity reporting area. This plan will attempt to standardize and stimulate the reporting of communicable diseases. At the present time there is considerable diversity of practice in this respect.

A standard has been established by the Public Health Service for the testing of color sense perception. The Ishihara color test plates are used for all first examinations for color sense perception.

In an attempt to standardize the treatment of syphilis in Public Health Service hospitals and in Federal penal and correctional institutions, a standard case record form has been prepared. It is expected that the use of this form will be of material assistance to the officers engaged in clinical work and also give valuable information as to the efficacy of the various modifications of orthodox antisyphilitic treatment that may be developed from time to time in these institutions.

WAR DEPARTMENT

Military Standardization.—For the purpose of developing items of military equipment which may properly be standardized there has been organized a technical committee consisting of representatives of the interested supply service and a representative from each of the other arms and services, the functions of which include determining if and where the need for standardization exists.

Preference for procurement to meet supply demands not met by the issue of available types is given to "standard article" over articles not standardized which may be used on occasions as "substitute standard article" to supplement the supply of standard articles.

During the past year 38 important items of military equipment have been standardized and 25 important items have been classed as obsolete.

Nonmilitary Standardization.—In standardization work not purely military the War Department cooperates with not only the Federal Specifications Board, the National Screw Thread Commission, and the division of simplified practice of the Bureau of Standards, but

also a large number of societies, including the American Standards Association, and the International Electrotechnical Commission.

The following supply branches of the Army have members representing the War Department on a number of technical committees of the Federal Specifications Board as indicated:

Quartermaster Corps	64	Medical Corps	9
Ordnance Department	10	Chemical Warfare Service	2
Air Corps	4	Signal Corps	7
Corps of Engineers	11		

Federal specifications form the basis of all related specifications prepared by the War Department, and it is mandatory that each specification so prepared be prefaced with the statement that its technical requirements conform in full detail with the Federal specification for the commodity as promulgated by the Federal Specifications Board giving the number of the master specification applying. Under the procedure now in use, Federal specifications have become actual purchase specifications, and the War Department expects to gradually reduce its own commercial specifications and substitute directly the Federal specifications. As this will involve changes in reference on a large number of drawings and related papers this change in the interest of Government economy and efficiency, affecting a large number of the commercial specifications of the War Department, will require a considerable period of time, but will be ultimately effected. It will not affect the strictly military specifications not within the scope of the Federal Specifications Board.

American Standards Association.—The War Department is a member body of the American Standards Association, and is represented on the American Standards Association standards council. It is represented on 35 sectional committees of the association. This representation is divided among the various supply branches as follows:

Quartermaster Corps	4	Signal Corps	3
Ordnance Department	16	Medical Corps	1
Air Corps	2	Chemical Warfare Service	2
Corps of Engineers	9		

Present Status of War Department Standardization and Results Accomplished During 1931.—Twenty-one new and revised specifications were prepared and approved during the year by the Quartermaster Corps. While numerous projects were in course of development and standardization, none were completed during the fiscal year. One hundred and thirty specifications were canceled during the year due to the promulgation of applicable Federal specifications in procurement form.

New and revised specifications of the Ordnance Department No. 39.

The metallurgical laboratory of the Ordnance Department has done considerable experimenting, with a view to finding a substitute for manganese in gun steel, and a substitute for nickel in gun steel. A satisfactory high-speed tool steel has been developed in which a strategic raw material has been eliminated. The work of inspecting castings and welded structures for internal defects by means of X-ray examination has been continued. The centrifugal process for casting of cannon has been fully developed and is now standard for small and medium calibers.

The Corps of Engineers standardization activities cover certain commodities entering into the construction of highway, pontoon, and foot bridges; locks, dams, revetments, floating plants, fortification work, including fixed and mobile antiaircraft 60-inch searchlights, lumbering, mapping, railroad and road-building equipment; also other items used for military purposes.

The Board on Engineer Equipment designs and develops equipment for military purposes including military railway equipment, and prepares specifications for same.

Specifications for all other items used for military purposes are prepared in the supply section, office, Chief of Engineers. For the purpose of conservation of critical and strategic raw materials, substitute specifications have been prepared for a number of items involving the use of those materials in their construction.

The coordination, numbering, and standardization of all specifications, including those prepared by other branches of the War Department and the Federal Specifications Board, are accomplished by the Corps of Engineers Technical Committee.

During the year ending June 30, 1931, the Corps of Engineers prepared six United States Army specifications.

In addition, the Corps of Engineers Technical Committee acted upon 76 specifications prepared by other War Department supply branches, and 239 specifications prepared by the Federal Specifications Board; also on 10 reports of the General Conferences on Simplification of Commodities from the Department of Commerce.

The following outstanding achievement was accomplished by the Corps of Engineers for the year ending June 30, 1931, as a result of studies, research and development, and tests:

Engineer Transits and Levels, Complete with Tripods.—In the interest of economy and standardization, one of the primary achievements accomplished during the past year was to standardize on the materials and construction of two important surveying instruments, so that the Government could obtain instruments of the highest quality and best workmanship without destroying competition.

A study made of the commercial instruments manufactured, revealed that there are wide variation in materials, construction, and characteristics of the integral parts of the instruments to meet specific requirements.

In view of the above, specifications were prepared covering an engineer transit, and dumpy level, complete with tripods. The specifications prescribed standard requirements for materials, construction of the integral parts, and the optical characteristics for both transit and level; also the diameters and number of screw threads per inch to conform with the approved standards of the National Screw Thread Commission, which establishes interchangeability of the screws for either instrument.

The specifications prescribe the material and construction of the tripod for transit and level; also that the foot plate of the instruments and tripod heads shall be provided with the new threads recommended for surveying instruments by the division of simplified practice, Bureau of Standards, Department of Commerce.

The standard specifications were submitted to, and accepted by the instrument manufacturers who agreed to standardize on future production of War Department instruments to comply with the requirements of the standard specifications.

The work of preparing suitable specifications for use in procuring medical and hospital supplies has lagged somewhat during the year, due to the diversion of personnel to the task of revising the supply catalogue of the Medical Department. Twenty-five specifications

covering 53 items were completed and approved, while 2 covering 2 items were canceled. The situation at the close of the fiscal year was:

Total approved specifications prepared by the Medical Department	744
Total available specifications prepared by other branches of the Army	42
Total available Federal specifications	36
Total	822

The above specifications cover a total of 1,254 items of medical and hospital supplies.

In addition to its own specification activities the Medical Department has furnished representation on the technical committees of the several branches of the Army and on a number of committees of the Federal Specifications Board.

In the preparation of specifications and manufacturing directives the Chemical Warfare Service is following, as fas as possible, the policy of standardization. While many of the specifications prepared are for articles of special nature, special emphasis is being placed on the use of approved trade standards and the latest engineering and manufacturing developments. All specifications prepared by the Federal Specifications Board are being used wherever applicable and contact is being maintained with commercial manufacturing organizations.

Fifteen new and revised specifications were prepared during the year.

In connection with the manufacture of matériel at Edgewood Arsenal, all procedures have been standardized and process directives prepared.

Seventy-four new and revised specifications were prepared during the past year by the Signal Corps. During the year 40 new standard specifications were promulgated and 66 standard specifications revised by the Air Corps. Information concerning the scope and purpose of the standardization activities of these two agencies as well as those of the Coast Artillery Corps and the Bureau of Insular Affairs was given in the Standards Yearbook, 1931.

INDEPENDENT ESTABLISHMENTS

BOARD OF SURVEYS AND MAPS OF THE FEDERAL GOVERNMENT

A joint report of the committee on aerial navigation maps and the committee on technical standards on standard symbols for air navigation maps was approved by the board. The symbols adopted were in some cases modifications of old symbols. Several new symbols were added to the list. The symbols adopted by the board will be incorporated in the new sheet of map symbols now in press for publication by the United States Geological Survey.

The board approved a report by the committee on cadastral surveys on specifications for descriptions of tracts of land for use in Executive orders and proclamations. The Department of State requested the board to prepare specifications and forms for use in writing descriptions of tracts of land appropriate for incorporation in Executive orders and proclamations, designed to be as nearly standard as practicable for adoption in the several Government departments and establishments.

The specifications as recommended by the board will be printed by the State Department for the use of all Federal departments in which Executive orders and proclamations originate.

The rules and specifications for the description of bounderies are grouped under seven sections as follows:

1. General rules.
2. The public domain.
3. Metes and bounds surveys.
4. Tracts shown upon miscellaneous plats.
5. Boundaries conforming to natural features of topography.
6. Undesirable forms of boundaries.
7. Maps.

Additional rules which require consideration in association with the subject are grouped under three additional sections.

COMPTROLLER GENERAL OF THE UNITED STATES

The General Accounting Office has continued active work in the standardization of the accounting forms and procedure used throughout the Government service, in which work it has had the cooperation of the Advisory Committee on Fiscal Accounting Forms and Procedure. During the past fiscal year the following standard forms and procedures have been prescribed:

United States Government Motor Fuel Tax Exemption—Receipt.—This standard form, No. 1066, which was referred to in the 1931 edition of the Standards Yearbook, was promulgated by General Regulations No. 73, July 17, 1930, and is now in general use in the Government service.

Receipt for Cash.—Investigations by this office and a report from the Chief Coordinator, Bureau of the Budget, revealed the fact that there were numerous special forms of cash receipt used as subvouchers to travel-expense vouchers, some departments having more than one. Standard Form No. 1012d was promulgated by General Regulations No. 36, Supplement No. 3, March 20, 1931, and is now in general use throughout the Government service in lieu of the numerous special forms heretofore used.

Public Vouchers for the Transportation of Passengers, Freight, and Express.—The Government transportation stock forms approved by the Comptroller of the Treasury in 1915 provided separate sets of forms for stating claims for services of public carriers over land-grant and nonland-grant railroads. General Regulations No. 75, dated June 26, 1931, promulgating revised standard transportation voucher forms, have consolidated the land-grant and nonland-grant forms and otherwise brought up to date the vouchers for the payment of transportation claims submitted by common carriers, thereby reducing the number of forms from 12 to 8.

Pay Voucher for Allowance for Quarters, Heat, Fuel, and Light, Act of June 26, 1930, 46 Stat. 818.—On June 19, 1931, under the provisions of the act of June 26, 1930 (46 Stat. 818), the President approved standardized regulations to govern allowances for living quarters, heat, fuel, and light for civilian officers and employees of the Government who are citizens of the United States permanently stationed in foreign countries. By General Regulations No. 76, June 29, 1931, Standard Forms Nos. 1069 and 1069a were prescribed for use by all departments and establishments concerned in vouchering claims of

civilian employees coming under the provision of that act, and with the active cooperation of the Bureau of the Budget, the Advisory Committee on Fiscal Accounting Forms and Procedure, the Permanent Conference on Printing, and the Public Printer the forms are being made available for use when the first payments are made under the law.

Statement and Certificate of Award.—Standard Form No. 1036, originally prescribed by General Regulations No. 51, June 18, 1925, was revised during the fiscal year and promulgated by General Regulations No. 51, Supplement No. 6, changing the title from "Abstract of Agreement, Advertising, Award, Form" to the title above indicated. The form is used to establish the fact of compliance with law and good business administration in connection with the award of Government contracts, both formal and informal.

General Ledger, Allotment Ledger, and Disbursing Office Ledger.—In connection with the installation of the uniform accounting system in various departments and establishments, three additional bookkeeping forms have been standardized as follows: Standard Form No. 1014, general ledger; Standard Form No. 1015, allotment ledger; and Standard Form No. 1014M, disbursing office ledger. These standard forms are for use when specially authorized by the Comptroller General of the United States.

Retirement Record Card.—Under the provisions of section 12(a) of the act of May 29, 1930, 46 Stat. 468, amending the civil service retirement act, the Civil Service Commission issued its retirement and personnel regulations (C. S. Form 2805), wherein was prescribed a form of retirement card (C. S. Form 2806) to replace Standard Form No. 1056. By General Regulations No. 65, Supplement No. 2, May 9, 1931, the use of Standard Form No. 1056 was discontinued. By the same general regulations it was prescribed that a pay card should be maintained for each employee of the Government subject to the provisions of the retirement act and the standard requirements to be shown on the pay card were specifically set forth.

The experience of the past year furnishes additional evidence of the fact that standardization of accounting forms results not only in marked economy in printing by printing one large edition of the standard forms instead of numerous small editions of special forms and by reducing the number of printing plates to be made and stored at the Government Printing Office, but also in the establishment of a uniform procedure for stating the accounts for which the standard forms were prescribed and expediting the audit thereof in the General Accounting Office.

Index to Decisions of the Accounting Officers.—This index, described in the report of this office for the 1931 edition of the Standards Yearbook, was received from the Public Printer during the fiscal year and distribution to the various departments and establishments has been completed, thus affording to all branches of the Government service a standard reference to all decisions affecting accounting matters that arise in the transaction of the public business.

Collections on Account of Unofficial Use of Facilities.—A uniform system for the handling of collections on account of the unofficial

use of facilities owned by public or private corporations, firms, or individuals and subscribed for and/or used by the Government was prescribed by General Regulations No. 40, Supplement No. 2, November 28, 1930. Such collections will hereafter be ordinarily handled through the official accounts of the collecting officer.

Extension of the Uniform Accounting System.—Surveys of accounting systems and procedures have been made in the past year in the Department of Agriculture and in Alaska for the purpose of introducing the uniform accounting system. Administrative accounting systems have been installed in nine districts of the Lighthouse Service, and detailed accounting instructions have also been promulgated for Alaska Railroad disbursing office at Anchorage, Alaska, for the consolidated disbursing office (Department of the Interior) at Juneau, Alaska, and for the consolidated purchasing and shipping unit, Department of the Interior, at Seattle, Wash. Studies have also been made of the accounting requirements of the central disbursing offices in the foreign service of the Department of State established pursuant to the act of February 23, 1931, Public No. 715, Seventy-first Congress, and an installation, under the supervision of representatives of the General Accounting Office, authorized for the Ottawa (Canada) office.

FEDERAL BOARD FOR VOCATIONAL EDUCATION

Some of the board's work may be regarded as promoting the adoption in the States of what may be designated as approved or accepted practice in teaching agriculture, trade, and industrial homemaking, and commercial pursuits, and some of this work in effect breaks over into actual practice of these pursuits, with the result of promoting standardized practices.

Two studies were completed by the board during the past year which will, it is believed, have some influence in standardizing practices in two different fields. The first of these is incorporated in a bulletin entitled "Light Frame Construction" prepared and issued jointly by the Federal Board for Vocational Education and the National Committee on Wood Utilization of the Department of Commerce. Of this bulletin the major portion is devoted to standardized practices followed in handling type jobs which constantly recur in the building of houses.

In a second publication, entitled "Fire Fighting," an attempt is made to lay down standard practices to be followed in fighting fire in cities and towns, and to formulate a standardized type of vocational instruction which can be applied to the training of men engaged in city fire departments.

In cooperation with the Federal Farm Board recently the Federal Board for Vocational Education has issued a series of monographs designed to furnish definite information and standards for setting up courses in the marketing of farm products. Standards in the field of agriculture are, of course, defined in the Department of Agriculture, but this work has some effect in promoting the adoption of these standards on the farms.

In the field of home economics also the work of this board may in some of its aspects at least have the effect of setting up what may

be called best or generally accepted practice for adoption locally in the public schools.

In the field of vocational rehabilitation of disabled civilians an effort is being made by the board in cooperation with the States to formulate and establish certain desirable standards of practice in following out the several steps involved in rehabilitating a disabled person which regularly include a preliminary survey of the case, vocational guidance, preparation for employment, placement in employment, and follow-up work after placement. An attempt is being made to standardize the practices to be followed in these several steps.

FEDERAL COORDINATING SERVICE

Office of the Chief Coordinator

The efforts of the office of the Chief Coordinator to secure standardization of telephone service, both in the District of Columbia and in the field, in the interests of operating economy and efficiency, were continued during the year with the active assistance of the Bureau of Standards.

For the purpose of effecting economies and standardizing procedure in the collection, compilation, and dissemination of statistical information by agencies of the Federal Government, a Federal Statistics Board was established, under the supervision of the Chief Coordinator, by Bureau of the Budget Circular No. 293, dated April 10, 1931.

Standardized regulations to govern allowances for living quarters, heat, fuel, and light for civilian officers and employees of the Government stationed in foreign countries, were promulgated by Bureau of the Budget Circular No. 298, dated June 19, 1931. Proposed changes considered desirable by departments and establishments are to be submitted to the Chief Coordinator for his consideration and action.

Federal Purchasing Board

This board is represented on the executive committee of the Federal Specifications Board.

During the current year the Federal Purchasing Board has assigned the standard symbols and terms of the Federal Standard Stock Catalogue to the items, or group of items, which have been under consideration. These classifications will be of great assistance and benefit to the Government procurement agencies.

In a similar way, the board has continued to collaborate in the Government use of simplified practice recommendations, and commercial standards, as they are believed to represent good business practice.

The main problem of the board is the standardizing of the purchasing procedure of the various departments and establishments, as far as this is feasible and conductive to economy.

Federal Specifications Board

The Federal Specifications Board has promulgated 43 new Federal specifications, 165 revisions of existing Federal specifications, and two cancellations, bringing the total of its specifications to 696. Some of the group specifications have been revised and divided into individual specifications noted below as revisions.

The new and revised specifications issued during the period of this report are as follows:

New Specifications:

F. S. symbol

C–H–111. Hair, horse, curled.
G–P–641. Preservers, negative, paper (photographic).
O–G–491. Glycerin (glycerol).
O–S–61. Salts, nickel (for) electroplating and electrotyping.
P–S–661. Solvent, dry-cleaning.
Q–C–571. Coke, foundry.
T–C–621. Cordage, hemp, tarred.
T–L–411. Lines, shot (for) line-throwing-guns.
T–T–911. Twine, jute.
V–T–291. Thread, linen.
W–B–131. Batteries, storage, ignition, lighting, and starting.
W–E–441. Electrodes, carbon, amorphous.
W–F–391. Fire-alarm systems, electric, hand operated.
W–T–411. Time-clock systems, electric.
W–W–101. Watchmen's report apparatus.
Z–F–351. Figs, canned.
Z–P–196. Peanut butter.
EE–D–691. Dressing, salad.
EE–E–911. Extracts, flavoring, and flavors, nonalcoholic.
EE–W–111. Water, table, effervescent.
GG–M–71, Machines, numbering, lever-type.
HH–L–361. Linings, brake-band.
NN–B–601. Boxes, wood, cleated-plywood construction.
NN–B–621. Boxes, wood, nailed and lock-corner.

F. S. symbol

NN–B–631. Boxes, wood, wire-bound.
PP–O–951. Oysters, canned.
QQ–T–201. Terneplate (roofing tin).
QQ–W–321. Wire, brass.
RR–F–221. Fencing, wire (barbed netting, and woven), black and galvanized.
SS–A–681. Asphalt, emulsion, slow-breaking-type (for use in road work).
SS–B–671. Brick, paving.
SS–F–111. Facings, foundry, carbon-base.
SS–M–501. Mold-wash, silica.
TT–B–601. Bone-black, dry, paste-in-Japan, paste-in-oil.
TT–C–231. Chrome, green, oxide.
TT–C–236. Chrome, green, pure, dry, paste-in-Japan, paste-in-oil.
TT–E–521. Enamel, pigmented (air-drying and baking), black.
TT–L–71. Lampblack, dry, paste-in-Japan, paste-in-oil.
TT–P–691. Prussian-blue, dry, paste in-Japan, paste-in-oil.
TT–U–451. Ultramarine-blue, dry, paste-in-Japan, paste-in-oil.
WW–N–351. Nipples, pipe, brass, steel, and wrought-iron.
LLL–B–631. Boxes, fiber, corrugated.
LLL–B–636. Boxes, Fiber, Solid.

Revised Specifications:

F. S. Symbol

C–M–321. Milk, condensed.
C–M–351. Milk, dry, powdered, skimmed, and whole.
H–B–151. Brushes, casting.
H–B–171. Brushes, cuspidor.
H–B–181. Brushes, dauber, long-paddle.
H–B–191. Brushes, dust, ceiling, and wall.
H–B–211. Brushes, dust, painters', flat.
H–B–216. Brushes, dust, painters', round.
H–B–251. Brushes, flowing, badger-hair.

F. S. Symbol

H–B–256. Brushes, flowing, skunk-hair.
H–B–261. Brushes, flowing, squirrel-tail-hair.
H–B–291. Brushes, glue, flat.
H–B–301. Brushes, glue, round.
H–B–351. Brushes, lacquering, flat.
H–B–371. Brushes, marking.
H–B–391. Brushes, mottling.
H–B–421. Brushes, paint, metal-bound, flat (high-grade).
H–B–431. Brushes, paint, metal-bound, flat (medium-grade).

F. S. Symbol

H–B–451. Brushes, radiator, bronzing.
H–B–491. Brushes, sash-tool, oval.
H–B–521. Brushes, scrubbing, clothes.
H–B–531. Brushes, scrubbing, deck.
H–B–541. Brushes, scrubbing, floor, hand.
H–B–621. Brushes, stencil (flag ends cut).
H–B–626. Brushes, stencil (flag ends preserved).
H–B–636. Brushes, stippling, wall.
H–B–651. Brushes, sweeping, floor, hair.
H–B–701. Brushes, varnish, flat (double X thickness).
H–B–706. Brushes, varnish, flat (triple X thickness).
H–B–731. Brushes, whitewash.
N–H–541. Hominy, lye, canned.
N–P–101. Paste, office.
O–A–51. Acetone.
O–A–491. Ammonium-chloride (sal ammoniac).
O–C–101. Calcium-carbide.
O–E–751. Ether, petroleum.
O–F–351. Fire-extinguishers, chemical, hand, carbon-tetrachloride type.
O–F–380. Fire-extinguishing-liquid, carbon-tetrachloride base.
O–P–571. Powder, insect (pyrethrum-powder).
O–S–571. Soda-ash.
O–S–581. Sodium-carbonate, granular (monohydrate crystals).
O–S–591. Sodium-cyanide (for use as an insecticide in fumigation).
O–S–601. Sodium-fluoride (insecticide).
O–S–606. Sodium-sulphate, anhydrous (for) photography.
O–T–671. Trisodium phosphate, technical (phosphate cleaner).
P–P–591. Powder, scouring (for) floors.
P–S–561. Soap, automobile.
P–S–566. Soap, chip.
P–S–571. Soap, grit, cake.
P–S–576. Soap, grit, hand.
P–S–586. Soap, laundry, liquid.
P–S–591. Soap, laundry, ordinary.
P–S–596. Soap, laundry, powdered.
P–S–606. Soap-powder.
P–S–611. Soap, salt-water.
P–S–616. Soap, toilet, floating, white.
P–S–618. Soap, toilet, liquid.
P–S–621. Soap, toilet, milled.
P–S–631. Soda, caustic (lye), (for) cleaning purposes.
P–S–641. Soda, laundry (washing-soda).
T–T–871. Twine, cotton, wrapping.
T–T–881. Twine, cotton, seine.
W–L–101. Lamps, electric, incandescent, large tungsten-filament.

F. S. Symbol

1931 and 1932 supplements to W–L–101, lamps; electric, incandescent, large, tungsten-filament.
W–L–111. Lamps; electric, incandescent, miniature, tungsten-filament.
1931 and 1932 supplements to W–L–111, lamps; electric, incandescent, miniature, tungsten-filament.
Y–N–711. Nuts, assorted and mixed.
Z–C–571. Coconut, prepared.
AA–D–201. Desks, wood.
AA–F–791. Furniture and cabinet, office, sectional, steel.
AA–S–71. Safes, burglar-resisting.
DD–C–791. Cups, pin and sponge.
EE–B–351. Biscuit (hard bread), or biscuit, canned.
EE–M–101. Matches, safety (full-size, in boxes).
EE–O–451. Oleomargarine.
EE–P–611. Powder, baking.
EE–S–71. Sauces, chili and Worcestershire.
EE–S–571. Soda, baking.
EE–S–631. Spices.
FF–H–101. Hardware, builders' (non-template).
FF–P–101. Padlocks.
GG–C–101. Calendar-pads and stands.
HH–B–671. Brick, fire-clay.
HH–C–451. Clay, fire.
HH–G–101. Gaskets, metallic-encased.
HH–P–36. Packing, asbestos, rod, high-pressure.
HH–P–46. Packing, asbestos, sheet, compressed.
HH–P–51. Packing, asbestos, valve-stem.
HH–P–96. Packing, fiber (for) lubricating and fuel oil.
HH–P–126. Packing, metallic, flexible.
HH–P–131. Packing, metallic and nonmetallic, plastic.
HH–P–161. Packing, rubber, wire-insertion.
HH–P–166. Packing, semimetallic.
KK–L–261. Leather, sole, vegetable-tanned.
PP–M–351. Mincemeat.
PP–T–771. Tuna fish, canned.
QQ–B–101. Bases, metal, (for) plaster and stucco construction.
SS–C–181. Cement, masonry.
SS–C–191. Cement, Portland.
SS–C–571. Coarse-aggregate, (for) Portland cement-concrete pavement or base (crushed stone, gravel, or slag).
SS–G–901. Gypsum, calcined.
SS–L–351. Lime, hydrated (for) structural purposes.

SS–Q–351. Quicklime, (for) structural purposes.
SS–R–191. Refractories, fire-clay, plastic.
SS–S–31. Salt, table.
SS–W–101. Waterproofing material, integral (for use with Portland cement-mortar or concrete).
TT–I–521. Ink, copying and record.
TT–I–542. Ink, marking, indelible (for) fabrics.
TT–I–549. Ink, red.
TT–I–556. Ink, stamp-pad.
TT–I–563. Ink, writing.
TT–P–36. Paints, lead-zinc base, ready-mixed and semipaste, white and tinted.
TT–P–71. Paints, ready-mixed and semipaste, green.
TT–S–271. Shellac, orange.
TT–W–251. White lead, basic-carbonate, dry paste-in-oil, and semipaste-in-oil.
WW–P–351. Pipe, brass, seamless, iron pipe size, standard, and extra strong.
WW–P–371. Pipe, concrete, plain.
WW–P–378. Pipe and tubing, copper, seamless pipe (standard, iron pipe size), tubing (for pressures up to 450 pounds per square inch).
WW–P–431. Pipe, welded-steel, black, and zinc-coated.
ZZ–A–611. Aprons, rubber, surgeons'.
ZZ–B–581. Bottles, hot-water, cloth-inserted.
ZZ–B–586. Bottles, hot-water, rubber.
ZZ–C–791. Cushions, ring, cloth-inserted.
ZZ–C–796. Cushions, ring, rubber.
ZZ–H–466. Hose, gasoline, rubber-metal.
ZZ–H–491. Hose, pneumatic.
ZZ–H–561. Hose, suction, water, smooth-bore.
ZZ–H–611. Hose, water, wrapped.
ZZ–I–111. Ice bags, helmet-shaped.
ZZ–S–311. Sheeting, rubber.
ZZ–S–901. Syringes, fountain, cloth-inserted.
ZZ–S–916. Syringes, fountain, rubber.
ZZ–T–751. Tubes, colon.
ZZ–T–831. Tubing, rubber.
CCC–C–521. Cloth, shade.
CCC–D–161. Denim, brown, shrunk.
CCC–D–171. Denim, brown, unshrunk.
CCC–S–271. Sheeting, cotton, bleached, wide.
CCC–S–291. Sheeting, cotton, unbleached, wide.
DDD–P–351. Pillowcases, cotton, bleached.
DDD–R–271. Ribbons, computing and recording-machine.
DDD–R–291. Ribbons, hectograph.
DDD–R–311. Ribbons, typewriter.
DDD–S–281. Sheets, cotton, bleached.
DDD–S–751. Stitches, seams, and stitching.
DDD–W–116. Waste, wool, colored.
GGG–G–501. Goggles, eyecup, chippers'.
GGG–G–541. Goggles, welders'.
GGG–H–191. Helmets, welders'.
GGG–S–311. Shields, welders', hand.
HHH–H–491. Hops.
HHH–O–531. Onions.
HHH–P–611. Potatoes, Irish.
HHH–P–621. Potatoes, sweet.
JJJ–B–91. Beans, canned (with pork).
JJJ–B–96. Beans, canned (without pork).
JJJ–B–106. Beans, dry.
JJJ–C–561. Cotton, absorbent.
JJJ–M–791. Mucilage.
JJJ–O–361. Oil, vegetable, salad.
JJJ–S–351. Sirup.
JJJ–W–151. Wax, sealing.
LLL–L–351. Linoleum, battleship.
LLL–L–361. Linoleum, plain, inlaid, and printed.
LLL–R–191. Receptacles, waste-paper, fiber, office and lobby.

Specification No. TT–I–528 (F. S. No. 265a), for black waterproof drawing ink, was withdrawn pending further research and revision of the specification.

Specification No. W–T–791 (F. S. No. 410), for radio receiving electron tubes was canceled because of the rapid progress in radio tube development, and frequent changes made since adoption of the specification.

The outline of form for Federal specifications was revised by the adoption of definitions and uses of the terms, types, grades, and classes, and standard typography, terms, abbreviations, spelling, etc. These standards are used by our committees as a guide in drafting specifications.

In the Standards Yearbook, 1931, it was stated that a number of Federal specifications for paper were canceled, and the respective specifications of the Joint Committee on Printing were adopted for field services, and that no new issues of Federal specifications would be issued. Upon request of several of the departments, it was decided to issue certain of these specifications as Federal specifications, to include purchase requirements, because the purchase requirements of the specifications as issued by the Joint Committee on Printing do not conform to the needs of many Government departments. Work is now progressing along this line.

State and city governments and industry continue to show increasing interest in Federal specifications. Industry, in particular, has shown greater interest by not only purchasing under these specifications, but by using them in connection with regular commercial sales in addition to sales to the Government. This broadening interest in the standards of Government purchases tends to increase competition on Government business, with resultant monetary savings.

Federal Standard Stock Catalogue Board

The publication of the Federal Standard Stock Catalogue is progressing rapidly and satisfactorily. This catalogue was authorized by Congress in March, 1929, to include information relative to nomenclature, descriptions, classifications, groups, specifications, stock numbers, code words, and other pertinent data.

Commercial and industrial establishments are exhibiting much interest in the catalogue, and many requests for complete volumes have been received. The catalogue comprises the following:

Section I, General Index of Federal Property, an alphabetical list indicating the class, group, and Federal specification for each article in the catalogue.

Section II, Classes for Storage and Issue, a segregation of Federal property for storage and issue purposes.

Section III, Groups for Procurement, a segregation of Federal property arranged for the information of purchasing officers of the Government.

Section IV, Federal Specifications.

During the year ending June 30, 1931, Section I of the catalogue was revised to May 1, 1931, and the revised edition has been issued. Of the 74 classes of Section II, 23 classes were printed and issued during 1931, making a total number of 41 issued to June 30, 1931. All but 10 of the remaining classes were in press in the Government

Printing Office on June 30, 1931. The compilation of data for Section III, Groups for Procurement, is proceeding satisfactorily, although not very rapidly, inasmuch as this is an entirely new undertaking. About 200 Federal specifications—(Section IV)—were printed and issued up to June 30, 1931, and the Federal Specifications Board is furnishing type script for additional Federal specifications as rapidly as they can be prepared.

Valuable assistance in the compilation of the catalogue has been furnished to the Federal Standard Stock Catalogue Board by the Federal Specifications Board; the division of simplified practice, and the division of textiles, Bureau of Standards; the General Supply Committee; and other departments and establishments of the Government.

Federal Traffic Board

The Federal Traffic Board has full authority, subject to review by the Chief Coordinator, to pass on all questions pertaining to—

Establishment of uniform classifications for all commodities shipped by the Government.

Drafting of plans for improving and standardizing methods of making shipments and settlement of accounts.

Adjustment of all questions which require application of remedial measures such as freight rates, switching, and terminal charges, etc.

All movements of freight consisting of two carloads or more, from any Government department, are routed by the Office of Coordinator for Traffic, which undertakes to provide the most economical route for the shipments.

The Federal Traffic Board has undertaken, in the past year, negotiations with airplane carriers to effect agreements providing for travel performed by Federal employees on official business at reduced rates. All-Member Letter No. 106 lists the carriers included in this agreement.

The Office of Coordinator for Traffic has routed, during the 12 months of the fiscal year 1931, a total of 36,739 carloads of Government freight, or an average of 3,062 cars per month; and during the past six months of the current year a total of 22,241 carloads, or an average of 3,707 cars per month.

Interdepartmental Board of Contracts and Adjustments

No additional standard contract forms have been promulgated during the year, but the contract board has been engaged in a proposed revision of existing standard forms and a study of problems in connection with contract legislation.

Interdepartmental Board on Simplified Office Procedure

The board has continued its work of standardizing the use of office supplies, material, and equipment, and the classifying, simplifying, and standardizing the routine administrative functions common in two or more departments or establishments during the year.

Envelopes.—The board was represented on the special interdepartmental committee which considered specifications of envelopes to be included in the Post Office Department schedule of envelopes for the fiscal year ending June 30, 1932. The committee decided to concentrate on a lighter color of kraft paper to be included in

the schedule for this fiscal year. Two item numbers will be added to the schedule—one with and one without window to accommodate the new size of currency. These enevelopes will have open sides in both instances.

Standard Forms.—In conjunction with the Permanent Conference on Printing, the Interdepartmental Board on Simplified Office Procedure approved the specifications for the revision of Standard Form No. 3, Estimates of Appropriations for Fiscal Year, proposed by the Bureau of the Budget, and the revision of this form was promulgated under date of March 23, 1931.

Revision of Standard Form No. 37, Notice of Retirement Status, was adopted by the board for use by all departments and establishments in order to make it applicable to the new retirement act now in force.

Publications.—The newly revised War Department publication, known as the Official Mileage Tables, used to determine the shortest usually traveled route when computing mileage vouchers of Government officials and employees, has recently been made effective and distributed to other departments and establishments for their use. The board contributed largely to the work of this revision through coordinated effort in securing information from the various activities for the War Department.

Permanent Conference on Printing

During the past year the Permanent Conference on Printing carried forward its task of investigating and proposing uniform standards, businesslike methods, and proper economies in the printing and binding and the distribution of Government publications.

The paper specifications committee, which functions under the authority of the Joint Committee on Printing, is charged with the responsibility of preparing specifications in determining standards of paper for public printing and binding for the current year.

Consideration was given to the uniformity of paper stock for fanfold and continuous-roll forms, and the conference approved sulphite writing paper for forms for temporary use and 30 per cent rag paper for forms for permanent use, the substance selected in each case to depend on the number of carbon copies desired.

The first edition of the Congressional Directory for each session of Congress being issued for temporary use only and the second edition, containing more complete information, being issued usually within a period of six weeks from the date of issue of the first edition, the conference further recommended to the Joint Committee on Printing that the first edition of the Congressional Directory for each session of Congress, printed for departmental use, be issued with paper covers and that only subsequent issues for each session be cloth bound and thumb indexed.

Standardized stock books and tablets manufactured and carried in stock by the Public Printer are meeting practically all requirements of the Government service. Deliveries are being made promptly, and the unit price of standardized books is considerably below former cost prices.

The conference adopted a recommendation indorsing a bill (H. R. 12036) presented to the last Congress, authorizing the Public Printer

to print and bind additional copies of any Government publication, not deemed confidential, which the Superintendent of Documents shall requisition for sale at not less than cost, as determined by the Public Printer, who shall also fix the prices and terms therefor; and the receipts from such sales in excess of the cost be deposited in the Treasury of the United States to the credit of miscellaneous receipts: *Provided*, That the Superintendent of Documents may designate any Government officer his agent for the sale of Government publications as shall be agreed upon by the Public Printer and the head of the respective department or establishment of the Government.

The Public Printer's program of maintaining a 30-day delivery schedule on certain classes of printing has resulted in the elimination of a vast number of demands for "rush" work. However, the departments have been requested to bear in mind the orderly method of requisitioning for printing and binding and the necessity for careful anticipation of their printing needs. By so doing rush orders can be reduced to emergency work only.

There has been some informal discussion by the conference and other coordinating bodies relative to the establishment of a centrally located "bureau of information concerning Government activities," which would also have available Government publications for sale. The Public Printer has indicated that the Government Printing Office would be glad to cooperate with other departments in establishing such a bureau.

With the cooperation of the several coordinating boards operating under the jurisdiction of the Bureau of the Budget and the General Accounting Office, 87 standard forms have been promulgated.

FEDERAL TRADE COMMISSION

The Federal Trade Commission has contributed to the standardization of certain trade practices, particularly as a result of its trade-practice conferences. It receives trade-practice rules adopted by different industries covering practices commonly prevalent. It approves certain of the rules which condemn practices violative of the law and encourages their observance. In this way the commission may be said to advance the cause of standardization of trade ethics.

The rules often are designed to serve as guides to the proper application of certain terms commonly used by industries in describing their products or services. The commission has approved certain carefully selected terms adopted by industries to describe their products, such as rebuilt machines, standard dimensions for jewelry or the metal used therein, glass products, and other articles.

In the interest of fair competition, the commission frequently has ordered firms or individuals to cease using certain misleading descriptions of articles offered for sale. Various word combinations and phonetic spellings have been prohibited. Common among these proscriptions are those against untruthful use of the word silk to describe goods not made of the cocoon of the silkworm.

The commission adopted a resolution in which it recognized the term "rayon" as "meaning and properly designating the artificial silk products, the basis and chief ingredients of which is cellulose." It was made clear that the "intent and effect of the resolution is to make such use of the term 'rayon' permissive but not mandatory."

On the whole, standardization may be described as a by-product of the commission's work rather than as a regular function because, after all, most of the commission's work pertains to individual cases involving various unfair methods of competition.

GOVERNMENT PRINTING OFFICE

The Government Printing Office maintains a technical division for the purpose of inspecting and testing all materials for the use of the office; to assist in the preparation of specifications for the purchase of materials; to maintain technical control over various materials manufactured by the office, such as printing inks, press rollers, type metal alloys, and adhesive compositions; and to conduct research with relation to the various materials and processes for printing and binding.

The Government Printing Office is authorized by Congress to engage in cooperative research in the same manner as other branches of the Government service. This cooperative work is conducted under the research associate plan by which associations or groups in the printing and binding industries place technically trained men at the Government Printing Office for intensive study of problems of mutual interest. The laboratory facilities and equipment of the Government Printing Office are available for such research work under the supervision of its technical director. The results of this cooperative research work are made available to the industry through trade publications or Government bulletins, as is the case with other work done by the technical division.

At the present time there are two research associates in the Government Printing Office; one associate representing the mechanical department of the American Newspaper Publishers Association, is working on newsprint paper and news inks; the other associate, representing the Employing Bookbinders of America, is working on bookbinding materials.

The following is an outline showing the scope of the technical work conducted by the Government Printing Office:

Materials:
- Paper.
- Textiles—
  - Bookbinding cloths.
  - Book-sewing threads.
- Bookbinding leather.
- Ruling inks.
- Adhesives.
- Book-stamping materials.
- Detergents.
- Press rollers.
- Printing and writing inks—
  - (*a*) Raw materials.
  - (*b*) Finished inks.

Materials—Continued.
- Type metal alloys—
  - (*a*) Linotype metal.
  - (*b*) Monotype metal.
  - (*c*) Stereotype metal.
  - (*d*) Electrotype backing-up metal.

Processes:
- Electroplating.
- Stereotyping.
- Photo-engraving.
- Various printing processes, such as offset, etc.

Research work on the above subjects is conducted in cooperation with—

Employing Bookbinders of America.
Mechanical department of the American Newspaper Publishers Association.
Standardization committee and research department of the United Typothetæ of America.

Printing Industries Division of the American Society of Mechanical Engineers.
National Association of Glue Manufacturers.
Technical Association of the American Paper and Pulp Industry.
International Bureau of Federation of Master Printers.
British Printing Industry Research Association.
German Printing Industry Research Association.
American Standards Association.
Paper manufacturers.
Type-metal supply companies.
Bookbinding leather manufacturers.
Individual printing, binding, and allied manufacturers.

The Government Printing Office has three representatives on the paper specifications committee appointed by the Congressional Joint Committee on Printing to fix the standards for paper and envelopes for the public printing and binding and for use of the Government departments and establishments in the District of Columbia. It is represented on the Federal Specifications Board by the technical director, and is also represented on several technical committees of the Federal Specifications Board.

The Public Printer is a member of the executive committee and the research and survey committee of the printing-industries division of the American Society of Mechanical Engineers, the standardization committee of the United Typothetæ of America, and the first honorary member of the British Printing Industry Research Association.

The technical director is a member of the Government paper specifications committee, the pulp and paper committee of the printing-industries division of the American Society of Mechanical Engineers, the paper testing committee and chairman of the subcommittee on the ink resistance of printing papers of the Technical Association of the Paper and Pulp Industry, the advisory committee on lithographic papers of the Lithographic Technical Foundation, and the advisory committee on permanent papers of the National Research Council.

As a further evidence in its interest in standardization, the Government Printing Office has recently become a member-body of the American Standards Association.

Contacts are also maintained with practically all foreign bodies dealing with standardization in the printing industry and with the leading Government and commercial printing plants throughout the world.

INTERSTATE COMMERCE COMMISSION

The Interstate Commerce Commission prescribes standard systems of accounts for steam roads, water carriers, electric railways, sleeping-car companies, express companies, pipe-line companies, telephone companies, and telegraph and cable companies, subject to the interstate commerce act.

The commission prescribes rules governing the form, arrangement, filing, and posting for public inspection of the tariff schedules of carriers, and advises and instructs the carriers in the matter of the character and publication of their tariffs, to bring about simplification, clarity, and uniformity.

The commission deals with several standardized features of railway operation, including the use, control, supply, movement, distribution, exchange, intercharge, and return of locomotives, cars,

and other vehicles used in the transportation of property. Such standardization of railway operating practices makes it possible for the railroads to function as a unit in the free movement of traffic. The commission prescribes regulations for the transportation of explosives and other dangerous articles by common carriers engaged in interstate or foreign commerce by land or water.

The commission, under authority of law, has prescribed the maximum and minimum height of drawbars for freight cars. Carriers are required to have couplers which are coupled automatically by impact and can be uncoupled without the necessity of a man going between the ends of cars. Standardization of couplers under the provisions of law has been in progress since 1903. Under the law and orders of the commission a minimum of 85 per cent of the cars in each train are required to be equipped with air brakes under the control of and operated by the engineer. The commission has issued tentative specifications and requirements for power brakes, and service tests are now in progress to determine the practicability of apparatus designed to conform to these specifications. The commission is now participating in an investigation looking toward the development and standardzation of automatic train-pipe connectors for air, steam, and signal lines. The commission has issued specifications prescribing the number, dimensions, location and manner of application of certain safety appliances required on cars and locomotives, such as sill steps, handholds, ladders, running boards, and hand brakes.

The commission prescribes rules, regulations, and instructions covering equipment, maintenance, inspection, and testing of all parts and appurtenances of locomotives used on the lines of common-carrier railroads.

In the investigation of accidents the commission frequently makes recommendations as to corrective measures, the purpose of which generally is to bring about standardization of railroad-operating rules, regulations, and practices so far as possible consistent with peculiar characteristics existing on individual lines.

The primary and most important benefit derived from the safety and locomotive inspection laws is increased safety of employees and travelers upon railroads.

The commission also fixes the limits of the standard time zones for the continental United States and Alaska.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

The National Advisory Committee for Aeronautics has recently organized a special conference on aeronautical nomenclature, for the revision of its standard Nomenclature for Aeronautics, which was published in 1926 as Technical Report No. 240. This special conference includes in its membership representatives of the Army Air Corps, the Bureau of Aeronautics of the Navy, the Aeronautics Branch of the Department of Commerce, the Bureau of Standards, and the National Advisory Committee for Aeronautics.

The nomenclature for aeronautics is adopted by the National Advisory Committee for the purpose of securing greater uniformity and accuracy in the use of terms relating to aeronautics in official

documents of the Government and, as far as possible, in technical and other commercial publications. Revisions in the nomenclature are made from time to time as the occasion arises to conform with changes in the general use of aeronautical terms. The nomenclature includes within its scope terms relating to types of aircraft, to lighter-than-air craft, to airplanes, to aircraft materials and structures, to airports and landing fields, to aerodynamics, to propellers, to instruments and auxiliary apparatus, and to engines.

The advisory committee has received suggestions as to new terms and modifications of existing terms for the Nomenclature for Aeronautics, and these suggestions are being carefully considered by the Special Conference on Aeronautical Nomenclature. The modifications as agreed upon by the conference will be incorporated in the revised nomenclature, which, after final approval, will be published as a technical report of the committee.

NATIONAL SCREW THREAD COMMISSION

The National Screw Thread Commission has continued its activities in bringing the screw-thread standards into wider use in industry. The three subdivisions—I. Standard Threads; II. Special Threads; and III. Plain and Thread Plug and Ring Gage Blanks—have been approved as commercial standards.

The commission is now giving attention to a needed revision of the class 4 fit to make it more practical, and to certain special threads such as those used on cylinders and valves for compressed gases.

PAN AMERICAN UNION

The Pan American Union is the international organization of the 21 Republics of America. It was established through the First International Conference of American States held at Washington in 1889–1890. The purpose of the Union is to promote good understanding, friendly intercourse, peace, and commerce among the 21 American Republics comprising the Pan American Union.

One of the functions intrusted to the Pan American Union is to act as a permanent commission of the international conferences of American States; to keep their records and archives; to assist in obtaining ratification of the treaties and conventions, as well as compliance with the resolutions adopted and to prepare the program and regulations of each conference.

As a result of resolutions adopted by different international conferences of American States, there were held under the auspices of the Pan American Union the Pan American Trade-Mark Conference, which approved a general inter-American convention on trade-marks and commercial protection and a protocol on the inter-American registration of trade-marks, tending to the uniformity of trade-marks; Pan American Conference on the Regulation of Automotive Traffic, which approved a draft convention on the regulation of automotive traffic; Pan American Commission on Customs Procedure and Port Formalities, which approved a series of resolutions and a convention tending to eliminate unnecessary port formalities and to standardize customs procedure.

The Fourth Pan American Commercial Conference was held in the Pan American Union from October 5 to 12, 1931. Included in the agenda were a number of topics which the Sixth International Conference of American States recommended should be considered at special conferences as follows: The development of ocean steamship service between the American Republics; compilation and dissemination of financial and economic statistics; standardization of commodities as an aid to commerce; uniformity of consular fees in the American Republics. (See Chapter II, p. 63.)

Efforts have been made also in the past for the codification of international law in the American Republics and the standardization of the monetary unit of all the American Republics.

PANAMA CANAL

This establishment is represented on a number of technical committees and the executive committee of the Federal Specifications Board, the American Society for Testing Materials, and the American Standards Association.

The Panama Canal continues to draft its own specifications for materials not covered by Federal specifications. Use is also made of certain War and Navy Department specifications for materials not covered by Federal specifications.

PUBLIC BUILDINGS AND PUBLIC PARKS OF THE NATIONAL CAPITAL

The Office of Public Buildings and Public Parks of the National Capital cooperates with the various standardizing and specification-making activities of the various Federal agencies, including the Interdepartmental Board of Contracts and Adjustments, Interdepartmental Board of Simplified Office Procedure, Federal Purchasing Board, Interdepartmental Committee on Fire Prevention and Protection (Fire Hazards Group), Federal Specifications Board Technical Committees, and the General Supply Committee.

In addition to the foregoing, during the past year the design section of the Office of Public Buildings and Public Parks has begun the work of standardizing those portions of specifications for construction projects which are applicable to practically all of the construction jobs handled by the office. The work accomplished to date, includes the standardizing of the general specifications and the standardizing of certain portions of the specifications for concrete. This standardized procedure is arranged in loose-leaf form so that it can be made to fit the majority of projects by the omission of certain paragraphs or the substitution of certain paragraphs for those included in the standardized draft. This procedure has eliminated considerable repetition in the specification writing and yet has permitted sufficient flexibility to avoid including a large amount of irrelevant or unnecessary information in any one specification. Under this procedure, complete specifications were written for approximately 40 projects during the year.

UNITED STATES BUREAU OF EFFICIENCY

The Bureau of Efficiency cooperated with the Bureau of Standards in research to establish standard methods and equipment for testing

paper, especially paper used in the manufacture of Government securities and currency.

UNITED STATES CIVIL SERVICE COMMISSION

What is regarded as the most important step toward the improvement of the Federal civil service and standardization of personnel practices in Government offices and establishments since the passage of the civil service law of 1883 was an Executive order of April 25, 1931, providing for a Council of Personnel Administration.

The President has shown a deep interest in the question of the efficiency of the Federal civil service. He realizes that the Government employment system should extend beyond the application of tests for entrance; that it is just as important to keep well-qualified men and women in the service as it is to place them there in the first instance; that the civil service employment scheme leaves something to be desired in the attention given to employees after their appointment; that there is a lack of available information as to what the Government service offers as a career.

With these things in mind, the President suggested to the president of the Civil Service Commission that a survey be made with a view to improving the Government's employment policy. The preliminary steps were taken in the office of the Civil Service Commission, and a tentative plan was worked out and presented to the President, with the result that the President issued the order of April 25, 1931, referred to.

The Executive order created a Council of Personnel Administration for the purpose of developing in the Federal Government a more effective system of employment and personnel management and to promote the general welfare of employees.

The details of the objectives are to establish a more effective liaison between the Civil Service Commission and the several departments; to coordinate personnel administration; to make more attractive the prospect of a career in the Federal service; to improve selection methods; to attract better people to the service; to reduce excessive turnover among the better qualified employees; to avoid excessive increase in personnel; to provide for the training of personnel assistants in the several departments and independent offices; to make available to the Government the best personnel practices of private industry; to develop a more adequate system of personnel records; in general, to increase the efficiency of the Government service.

Leaders in personnel matters in private industry, in research organizations, and in education have signified their willingness to serve as advisers.

The survey has in view, among other things, the collection and dissemination of information which will make available a more definite knowledge of lines of promotion; of what is taking place in the way of advancement of those who have entered the service; the more ready transfer of competent employees from one department to another to fill vacancies which now in most cases are filled by new appointments; training courses for personnel assistants in each department, and the encouragement of training for Government service in the colleges and universities.

The first meetings of the council, which is made up of the members of the Cabinet and the heads of some of the more important independent bureaus, have been held in the office of the Civil Service Commission. The idea has been accepted generally as sound and economical, and there is every indication that there will be full cooperation in Government circles.

Those outside the Government who are to serve on advisory committees will cooperate in the formulation of a program in which they can give the Government the benefit of their research and experience in their several fields of activity.

VI. BUREAU OF STANDARDS

An outline of the origin and functions of the bureau is given in the 1927 Standards Yearbook. Circular No. 1 and the 1931 annual report of the director should be consulted for a more comprehensive survey of the bureau's work.

RELATION TO GOVERNMENTAL AGENCIES

The relation of the bureau to the various governmental, Federal, State, and municipal agencies is outlined briefly in the 1927 Standards Yearbook.

RELATION TO SCIENCE, COMMERCE, AND INDUSTRY

PUBLICATIONS

The results of the bureau's work are made available in printed publications. Approximately 2,150 pamphlets have been issued to date. Releases to the daily press give briefly the more important features of the bureau's activities from a popular point of view. More detailed abstracts are prepared for the use of scientific and technical journals. The results of original investigations in science and technology are reported in full in the Bureau of Standards Journal of Research, which is issued once a month and is obtainable on a subscription basis. Compiled technical or administrative matter is issued as a circular; for example, the standard petroleum oil tables, properties of aluminum and light alloys, test schedules, recommended specifications, and the like. Codes and reference texts, such as the codes of electrical and logging practice, and the manual for weights and measures officials, which must be carried about by the user, are issued in a series of pocket-size handbooks.

The program for the simplification of commercial practice leads to definite proposals known as Simplified Practice Recommendations, while agreements on the desirable minimum quality of products are published as Commercial Standards. Pamphlets on house construction, plumbing codes, zoning regulations, etc., are placed in a special series known as Building and Housing Publications. Charts, conference reports, and material not suitable for other series appear as Miscellaneous Publications.

The bureau's Technical News Bulletin is a monthly periodical containing progress reports of work in the laboratories, brief data on completed investigations, notices of important conferences, and lists of all new publications by members of the staff in the bureau's series and in technical journals.

The Commercial Standards Monthly reviews progress in the field of commercial standardization, both at the bureau and elsewhere. Special articles by leaders in commercial standardization are a valuable feature, and brief references are also given to some of the bureau's technical work.

Mimeographed letter circulars on specialized subjects are also prepared to answer inquiries by mail. In addition to the Government publications, papers on subjects within the respective specialties are printed in outside journals.

The printed publications of the bureau are sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscriptions may be placed in advance for the Journal of Research, the Technical News Bulletin, and the Commercial Standards Monthly. The bureau issues a descriptive list (Circular No. 24, together with supplement) of its published material. Announcement leaflets giving titles of all new publications in the bureau's series are sent on request to those concerned with the work.

RESEARCH AND TESTING

RESEARCH

Research on problems arising in connection with standards is by act of Congress a primary function of the bureau. Such work includes the divising of methods and apparatus for the precise measurement of standards, the frequent intercomparison of standards to determine their permanency, and the evaluation of standards by absolute methods.

Physical Constants.—The precise determination of certain physical constants and the properties of materials is closely related to the establishment of standards. The standard temperature scale, for example, is defined by a number of thermometric fixed points, such as the boiling point of oxygen, the freezing and boiling points of water, the boiling point of sulphur, and the freezing points of silver and gold. Careful redeterminations of important physical constants, such as the Newtonian constant of gravitation, the absolute value of gravity at Washington, and the mechanical equivalent of heat, lead to more precise evaluations of these widely used "constants." The determination of the properties of saturated steam under high pressures finds immediate application in the design of steam turbines, while data on the properties of ammonia have corresponding uses in refrigeration engineering.

Research Associates.—Much of the bureau's research is directed to the application of science in commerce and industry. The research associate [1] plan permits industrial associations or groups to place qualified men at the bureau for intensive study of selected problems approved by the Director of the Bureau of Standards. Such men utilize the bureau's laboratory facilities and equipment and have the same status as any bureau employee, except that their salaries are paid by the supporting group or association.

The work of a research associate on problems of concern to an entire industry is one of peculiar trust. Research results are immediately available to the industry concerned and are frequently printed in bureau publications. Devices or processes developed during research may not be patented for the benefit of the individual or the group, but are for the free use of the industry, the Government, and the public. Correspondence relating to the work of the research associate is conducted through official channels except on purely personal matters.

A list of the research associates and projects under investigation arranged according to sustaining organizations is given in the following table:

[1] For further details see B. S. Circular No. 296.

Research associates

[This table contains the name of every research associate on duty at the Bureau of Standards during the period from January 1 to October 15, 1931, inclusive. Many of these associates were assigned to the bureau for only part of the period covered]

Assigned by—	General field of research	Specific project	Research associate
Aluminum Co. of America, New Kensington, Pa	Engineering structures	Fatigue of alclad duralumin	Gough, C.
American Association of Textile Chemists and Colorists, L. A. Olney, chairman, research committee, Lowell, Mass.	Textiles	Action of light on silk; determination of isoelectric point of wool.	Harris, M.
American Bridge Co., 71 Broadway, New York, N. Y.	Engineering structures	Strength of steel columns and of welded details	Seaquist, E. O.
American Bureau of Welding, 29 West Thirty-ninth Street, New York, N. Y.	do	Strength of welded joints	Ramberg, W. G. C.
American Dental Association, 212 East Superior Street, Chicago, Ill.	Dentistry	Study of dental materials	Paffenbarger, G. C.; Taylor, N. O.
American Electric Railway Association, 292 Madison Avenue, New York, N. Y.	Engineering structures	Strength of welded rail joints	Wharton, A.
	Lubrication	Lubrication and efficiency of transmission gears	McKee, T. R.
American Electroplaters' Society, 434 South Wabash Avenue, Chicago, Ill.	Electroplating	Protective coatings	Strausser, P. C. W.
American Face Brick Association, 205 West Wacker Drive, Chicago, Ill.	Structural	Face brick absorption and transverse compression; efflorescence.	Palmer, L. A.
American Foundrymen's Association, 222 West Adams Street, Chicago, Ill.	Metallurgical	Liquid shrinkage in metals	Ash, E. J.
American Gas Association, 342 Madison Avenue, New York, N. Y.	Gas engineering	Gas burner design	Jenkins, B. D.; Merritt, C. J.
	Soil corrosion and protective coating.	Testing proprietary pipe line coatings; study of methods for identifying corrosive soils.	Ewing, S.
American Institute of Steel Construction, 200 Madison Avenue, New York, N. Y.	Engineering structures	Formed sheet steel floors	Frankland, J. M.
	Fire resistance	Fire tests of welded steel floor construction	Welch, C. W.
American Petroleum Institute, 250 Park Avenue, New York, N. Y., in cooperation with National Automobile Chamber of Commerce, 366 Madison Avenue, New York, N. Y., and Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Fuels and engines	Cooperative fuel research (relationship between automotive engines and fuels).	Bridgeman, O. C.; Bright, B. B.; Carter, F. R.; Ellenberger, W. J.; Endlein, C., jr.; Gary, F. B.; Hicks, R. L.; Querfeld, D. W.; Rodgers, G. C.; Sprinkle, L. W.; Webber, W. W.; Wood, M. K.
American Petroleum Institute, 250 Park Avenue, New York, N. Y.	Petroleum	Chemical constituents of petroleum	Barron, H. A.; Blount, E. A.; Bradt, L.; Bruun, J. H.; Glasgow, A. R.; Hiatt, J. E.; Hoover, S. R.; Leslie, R. T.; Miller, C. N.; Rose, F. W.; Schicktanz, S. T.; Schoonover, P.; White, J. D.
	do	Thermodynamic properties of petroleum hydrocarbons.	Green, C. B.; Harrington, E. A.; Jessup, R. S.; Snyder, E. H.
	Soil corrosion and protective coatings.	Engineering principles in pipe-line protection; tests of protective coatings.	Scott, G. N.
American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Lubrication	Lubrication research	Bell, H. P.; Hopkins, H. H.; McKee, T. R.; Snyder, G. H.
	Steam tables	Thermal properties of water	Burr, R. A.; Fiock, E. F.; Ginnings, D. C.; Osborne, N. S.; Stimson, H. F.

American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa.	Structural	Research in cement; testing	Dwyer, J. R.; Messimer, L. A.; Wagner, L. A.
Asphalt Shingle and Roofing Institute, 2 West Forty-fifth Street, New York, N. Y.	Asphalt and asphalt roofing	Durability of felt	Strieter, O. G.; Waters, C. E.
Associated Knit Underwear Manufacturers of America, Roy A. Cheney, secretary, Utica, N. Y.	Textiles	Standardization of underwear sizes; development of specifications; properties of knit underwear fabric.	Hamlin, C. H.
Atlas Lumnite Cement Co., 135 East Forty-second Street, New York, N. Y.	Cement	Research in cement; testing, etc	Rapp, P.
Binders Board Manufacturers Association, O. M. Porter, 122 East Forty-second Street, New York, N. Y.	Paper	Standardization of binders board	Allen, W. F.
Brown Co., Berlin, N. H	do	Preservation of records	Rasch, R. H.; Stone, G. O.
C. F. Brush Estate, Cleveland, Ohio	Heat measurement	Spontaneous generation of heat	Harrington, E. A.
Bunting Brass & Bronze Co., 715 Spencer Street, Toledo, Ohio.	Metallurgical	Testing of bronze	Eggenschwiler, C. E.
Bureau of Efficiency, Washington, D. C	Paper	Improvement of paper currency	Hamill, G. K.; Worthington, V.
Carbide & Carbon Chemical Co., 30 East Forty-second Street, New York, N. Y.	Antifreeze solutions	Thermal properties of liquids	Ellenberger, W. J.; Gary, F. B.; Querfeld, D. W.; Webber, W. W.
Cast Iron Pipe Research Association, 566 Peoples Gas Building, Chicago, Ill.	Soil corrosion and protective coatings.	Strength of corrosion products of cast iron; location of corrosive soils; statistical study of Bureau of Standards' data on corrosion of cast iron.	Grodsky, V. A.
Clock Manufacturers' Association of America, 644 Drexel Building, Philadelphia, Pa.	Lubrication	Lubrication of fine mechanisms	Bulkley, R.; Moulton, J. R.; Peterson, L.
Committee of Marine Underwriters, 82 Beaver Street, New York, N. Y.	Spontaneous heating and ignition.	Spontaneous heating and ignition of jute	Obold, W. L.
Common Brick Manufacturers' Association of America, 2121 Guarantee Title Building, Cleveland, Ohio.	Structural	Moisture transmission of brick walls Strength of reinforced brick masonry	Harrison, W. W.; McBurney, J. W. Olson, A.
Commonwealth Fund Fellowship, 41 East Fifty-seventh Street, New York, N. Y.	Fuels and engines	Combustion in engine cylinder	Steele, S.
Hugh L. Cooper Co. (Inc.), 101 Park Avenue, New York, N. Y.	Structural	Use of clays in concrete mixtures	Parsons, D. A.
Copper and Brass Research Association, 25 Broadway, New York, N. Y.	Metallurgical	Corrosion of copper roofing materials	Kosting, P. R.
Dardelet Threadlock Corporation, 120 Broadway, New York, N. Y.	Engineering structures	Locking screw threads	Greer, D. McK.; Pendorf, H.; Brayshaw, T. C.
Elevator Safety Code Committee, subcommittee on research, approval and interpretation, care of American Standards Association, 29 West Thirty-ninth Street, New York, N. Y.	Safety engineering	Elevator safety equipment; development of methods and instruments; construction, maintenance, operation, etc.	Brown, L. W.; Dickinson, J. A.; Seaquist, W. H.
Fixed Nitrogen Research Laboratory, Department of Agriculture, Washington, D. C.	Low temperature calorimetry.	Specific heats at low temperature	Southard, J. C.
Indiana Limestone Association, Bedford, Ind	Structural	Study of physical properties of Bedford limestone.	Dutton, H. H.
Institut International du Froid, 9 Avenue Carnot, Paris, France.	Heat measurement	Properties of carbon dioxide	(Vacant during the present year.)
Johns-Manville (Inc.), Manville, N. J	Heat transfer	Heat transfer between solids and fluids	Kennard, R. B.
Lithographic Technical Foundation, R. F. Reed, technical director, 320 West Forty-second Street, New York, N. Y.	Paper	Standardization of lithographic papers	Cobb, R. M.
Masonry Mortar Research Fellowship, L. B. Rainey, chairman, Continental Clay Products Corporation, Oliver Building, Pittsburgh, Pa.	Structural	Study of masonry cements	Palmer, L. A.; Parsons, D. A.

Research associates—Continued

Assigned by—	General field of research	Specific project	Research associate
Midvale Co., Philadelphia, Pa.	Metallurgical	Properties of metals at high temperatures	Kahlbaum, W.
National Association of Dyers and Cleaners, Walter H. Franks, acting manager, Silver Spring, Md.	Textiles	Properties of dry cleaning solvents; adsorption of liquids by fibrous materials.	Hughes, E. E.; Ramsey, E. C.; Troxel, S. M.
National Association of Hosiery and Underwear Manufacturers, L. R. Keeffe, acting secretary, 468 Fourth Avenue, New York, N. Y.	do	Cause and prevention of defects in hosiery; development of specifications; analysis of hosiery manufacturers' problems.	Schenke, E. M.; Shearer, H. E.
National Building Units Association, 1600 Arch Street, Philadelphia, Pa.	Structural	Concrete building units	Bowen, E. E. W.
National Research Council, Washington, D. C.	Fuels	Motor fuels	Bridgeman, O. C.; Gary, F. B.
	Paper	Preservation of records	Allen, W. F.; Emley, A. L.; Hicks, J. F. G.; Holt, W. L.; Kimberly, E. A.
	Sound	Acoustic properties of building materials	Miller, C. E.
National Terra Cotta Society, 230 Park Avenue, New York, N. Y.	Structural	Investigation of architectural terra cotta	Pole, G. R.; Schurecht, H. G.
Nonferrous Ingot Metal Institute, 308 West Washington Street, Chicago, Ill.	Metallurgical	Nonferrous ingot metal research	Gardner, H. B.
Port of New York Authority, 80 Eighth Avenue, New York, N. Y.	Engineering structures	Strength of bridge towers	Back, G.; Petrenko, E. S.
Portland Cement Association, 33 West Grand Avenue, Chicago, Ill.	Structural	Constitution and hardening of Portland cement	Arden, A. T.; Bogue, R. H.; Dillon, M. M.; Lerch, W.; Taylor, W. C.
Radiological Research Institute, Beaumont Building, St. Louis, Mo.	X rays	Quality of scattered radiation	Tucker, K.
E. R. Squibb & Sons, New Brunswick, N. J.	Explosive limits	Properties of gaseous mixtures	Webber, W. W.
Technical Committee of the Producers of Electric Furnace Abrasives, A. H. Anderson, chairman, Norton Co., Worcester, Mass.	Electric-furnace abrasives	Abrasive grain sizing	de Sveshnikoff, V. V.
United States Gypsum Co., 311 West Adams Street, Chicago, Ill., in cooperation with Gypsum Association, 211 West Wacker Drive, Chicago, Ill., Henry Klein & Co., Elmhurst, Long Island, N. Y., and N. W. Magnestie Co., Farmers Bank Building, Pittsburgh, Pa.	Fire prevention	Fire prevention and protection in cooperation with Federal Fire Council.	Lewis, L. M.; Lockwood, L. H.
Utilities Research Commission, 72 West Adams Street, Chicago, Ill.	Insulating liquids	Preparation of pure hydrocarbons	Astin, A.
		Direct current properties of insulating liquids	Gardiner, G. W.
		Alternating current properties of insulating liquids.	Mair, B. J.

Current work of research associates relating to standards of quality, performance, or practice is described under activities and accomplishments.

Branch Research Laboratories.—In addition to the research work in Washington, branch laboratories are in operation at Ames, Iowa, and at Auburn and Tuscaloosa, Ala., where new uses for waste products are developed. These are joint projects in cooperation with Iowa State College, the Alabama Polytechnic Institute, and the University of Alabama. A special laboratory for investigation of clay products is operated in cooperation with Ohio State University at Columbus.

Coordination with Other Research Laboratories.—With the aid of the National Research Council, the American Society for Testing Materials Committee E–9 on correlation of research, the various research laboratories, and many national organizations, every effort is made to coordinate all bureau research work with that done by other bodies to provide the maximum national benefit and to avoid duplication of effort.

Research within the Government service is coordinated by the Chief Coordinator of the Bureau of the Budget.

TESTING

Through the testing of standards sent to the bureau by science and industry, research on standards finds its direct application and fruition. The common acceptance of, and conformity to, uniform standards of measurement are essential to the fullest development of the commerce and industry of the Nation. The testing service of the bureau provides the means of establishing this uniformity.

Fundamental testing involving a comparison, direct or otherwise, with reference standards covers a wide range, including such items as end standards of length; tolerance gages; screw-thread gages; standard invar tapes for precise geodetic work; precision weights; volumetric glassware of all kinds; precision time pieces; mercurial and other types of thermometers; pyrometers; barometers; pressure gauges; water-current meters; saccharimeters; electrical standards of electromotive force, resistance, inductance, and capacitance, electrical measuring instruments; optical plane surfaces; and many others.

In addition, the bureau acts as a testing agency for the various departments of the Government, and in this capacity conducts a great variety of tests to determine whether the item submitted conforms with specifications. This work includes performance tests of a great variety of machines, instruments, and mechanical appliances; analyses to determine the chemical composition or the purity of samples; tests of cement, lime, leather, paper, rubber, textiles, paints, varnishes, etc., to determine conformance with Federal specifications; and tests to determine the physical properties of metals and building materials. Tests of this character are made for the public only in instances where private laboratories are not suitably equipped.

Branch Testing Laboratories.—Branch testing laboratories are maintained at Northampton, Pa., Columbus, Ohio, Denver, Colo., and San Francisco, Calif.

Federal Testing Laboratories.—Several departments of the Federal Government have established laboratories for special testing work where required by the nature or number of tests. When specific investigations are under way the work is frequently divided and coordinated among several Federal laboratories. A list of such laboratories was given on page 144 of the 1927 Standards Yearbook.

Commercial Testing Laboratories.—Because of the large amount of official testing conducted by the bureau it is impracticable to make tests for private individuals if other laboratories can do the work. In Miscellaneous Publication No. 90, entitled "Directory of Commercial Testing and College Research Laboratories," and its supplement, information is given concerning commercial testing laboratories with their branch laboratories or offices. This list has been compiled in recognition of the desirability under present conditions of independent commercial testing service and in anticipation of a marked increase in the demand for such service in both domestic and export trade.

Heretofore purchasers not individually equipped to make their own acceptance tests have been reluctant to adopt the specification method of buying commodities because of the fixed belief that many manufacturers work off "seconds" on such customers. The knowledge that they can at any time, when they so desire, call upon testing laboratories to check the deliveries made to them on contracts based on specifications with which certificates have been issued by the manufacturers will induce a large number of such purchasers to take full advantage of the specification method of buying.

COMMERCIAL STANDARDS

The Bureau of Standards has assisted over 120 industries, as represented by more than 10,000 firms and associations, to reduce the avoidable wastes resulting from the production and distribution of too many varieties of product. Excessive diversity in sizes, dimensions, grades, and qualities have been reduced to those varieties in common or general demand.

The work of the four divisions of the bureau's commercial standards group includes the simplification of commodity sizes and dimensions as carried on by the division of simplified practice; the promotion of standard building and plumbing codes, zoning ordinances, etc., by the division of building and housing; promulgation of nationally recognized specifications, and the compilation of lists of willing-to-certify manufacturers of products made in accordance therewith, by the division of specifications; and cooperation with industry in selecting and establishing definite grades and qualities as commercial standards, by the division of trade standards.

Assistance in the correlation of the specifications produced by the Federal Specifications Board with those produced by commercial agencies is rendered by this group, which has liaison duties with other branches of the Department of Commerce and with other departments on matters in this field.

In formulating the plans and policies for the guidance of the activities of the division of simplified practice, the bureau is aided

by a planning committee which meets quarterly at the Department of Commerce. The membership of this committee is as follows:

E. W. McCullough, manager, department of manufacture, Chamber of Commerce of the United States, Washington, D. C.
Rear Admiral T. T. Craven, chief coordinator, Bureau of the Budget, Washington, D. C.
G. A. Renard, secretary, National Association of Purchasing Agents, 11 Park Place, New York, N. Y.
A. W. Shaw, formerly chairman conservation division of War Industries Board, 8 South Michigan Avenue, Chicago, Ill.
A. A. Stevenson, 201 Kent Road, Ardmore, Pa.
L. P. Alford, the Ronald Press Co., 15 East Twenty-sixth Street, New York, N. Y.
H. R. Young, secretary, Retailers' National Council, Munsey Building, Washington, D. C.

A complete description of the procedures followed by the divisions of the commercial standards group in their cooperative work with producers, distributors, and consumers will be found on pages 180–183 of the Standards Yearbook for 1931.

ADVISORY COMMITTEES

Where a group interested in the formulation of standards for a given industry, or in the investigation of specific subjects, is not otherwise organized for the purpose, the bureau encourages the formation of an advisory committee. These committees function in the same manner as an informal industrial committee except that the secretarial work is usually conducted by the bureau. A list of these committees follows:

Name	Purpose	Secretary	Membership
Advisory committee on acid in leather	To advise on technical questions concerning effect of acid on leather.	T. Blackadder, American Leather Chemists' Association and Tanners' Council of America, care of Rohm & Haas, West Washington Square, Philadelphia, Pa.	Manufacturers of leather goods.
Advisory committee on automobile tires	To advise on technical questions relative to specifications and methods of test.	George Flint, Rubber Manufacturers' Association, 250 West Fifty-seventh Street, New York, N. Y.	Automobile tire manufacturers.
Advisory committee on cement	To advise on work on the constitution and hardening of Portland cement.	George E. Warren, Portland Cement Association, 33 West Grand Avenue, Chicago, Ill.	Committees of Portland Cement Association and American Society of Civil Engineers.
Advisory committee on ceramics	To assist in outlining proposed investigations and reviewing results obtained.	A. V. Bleininger (chairman), Homer-Laughlin China Co., Newell, W. Va.	Ceramic associations, brick associations, and tile associations.
Advisory committee on city planning and zoning.	To encourage proper city planning and zoning by drafting standard State enabling acts, under which municipalities may take action, and through other publications.	Dan H. Wheeler, Bureau of Standards, Washington, D. C.	City planners, engineers, realtors, and housing experts.
Advisory committee on colored sanitary ware.	To standardize colors for sanitary ware	G. W. Wray, Bureau of Standards, Washington, D. C.	All manufacturers of colored sanitary ware.
Advisory committee on cordage	To advise on technical questions dealing with cordage.	J. S. McDaniel (chairman), 350 Madison Avenue, New York, N. Y.	Cordage Institute.
Advisory committee on cotton	To advise on technical questions concerning cotton.	R. T. Fisher, 80 Federal Street, Boston, Mass.	Manufacturers of cotton textiles.
Advisory committee on the determination of the composition of petroleum.	For consultation on the technical aspects of the investigation.	J. B. Hill (chairman), Atlantic Refining Co., 3144 Passyunk Avenue, Philadelphia, Pa.	Representatives of oil producers.
Advisory committee on enameled sanitary ware.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of enameled sanitary ware.	I. J. Fairchild, Bureau of Standards, Washington, D. C.	All manufacturers of enameled sanitary ware.
Advisory committee on fire hazard tests of jute.	To determine whether jute is susceptible to spontaneous heating.	John S. Kemp, 82 Beaver Street, New York, N. Y.	Committee of Marine Underwriters.
Advisory committee on fire tests of welded steel floor construction.	To conduct tests to determine fire resistance of welded steel floor construction.	F. H. Frankland, 200 Madison Avenue, New York, N. Y.	Committee of American Institute of Steel Construction.
Advisory committee on hosiery	To advise on technical questions concerning hosiery.	L. R. Keeffe (acting), National Association of Hosiery and Underwear Manufacturers, 468 Fourth Avenue, New York, N. Y.	Hosiery manufacturers.
Advisory committee on hospital rubber supplies.	To advise on technical questions relative to specifications and methods of test.	George Flint, Rubber Manufacturers' Association, 250 West Fifty-seventh Street, New York, N. Y.	Manufacturers of hospital supplies.
Advisory committee on lithographic papers.	To advise on research on standardization of lithographic papers.	R. F. Reed, Lithographic Technical Foundation, University of Cincinnati, Cincinnati, Ohio.	Printers and manufacturers of paper and ink.
Advisory committee on mechanical rubber goods.	To advise on technical questions relative to specifications and test methods.	George Flint, Rubber Manufacturers' Association, 250 West Fifty-seventh Street, New York, N. Y.	Manufacturers of mechanical rubber goods.
Advisory committee on porcelain plumbing fixtures.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of porcelain plumbing fixtures.	I. J. Fairchild, Bureau of Standards, Washington, D. C.	All manufacturers of porcelain plumbing fixtures.

Advisory committee on preservation of records.	To advise on research on preservation of records.	H. K. Benson, National Research Council, Washington, D. C.	National Research Council; paper makers, merchants, and consumers; Government laboratories.
Advisory committee on properties of watch and clock lubricants.	To study the properties of lubricants for fine mechanisms.	F. Keller (chairman), Western Clock Co. of New York (Inc.), 109 Lafayette Street, New York, N. Y.	Clock Manufacturers' Association of America.
Advisory committee on rubber floor tile	To advise on technical questions relative to specifications and methods of test.	George Flint, Rubber Manufacturers' Association, 250 West Fifty-seventh Street, New York, N. Y.	Manufacturers of rubber floor tile.
Advisory committee on standardization builders' hardware.	To standardize finishes, nomenclature, definitions, types, and general practice affecting builders' hardware.	I. J. Fairchild, Bureau of Standards, Washington, D. C.	All manufacturers of builders' hardware.
Advisory committee on thermochemical research.	To advise on program of investigations	F. R. Bichowsky (executive secretary), Division of Physical Chemistry, Naval Research Laboratory, Bellevue, Anacostia, D. C.	Representatives of General Chemical Co., Fixed Nitrogen Research Laboratory, and Bureau of Standards.
Advisory committee on thermodynamic properties of petroleum products.	To direct research dealing with the physical properties of petroleum oils.	A. E. Pew, jr. (chairman), Sun Oil Co., 1608 Walnut Street, Philadelphia, Pa.	American Petroleum Institute.
Advisory committee on underwear	To advise on technical questions dealing with underwear.	Roy A. Cheney, Associated Knit Underwear Manufacturers, Union Station, Utica, N. Y.	Underwear manufacturers.
Advisory committee on wool	To advise on technical questions concerning wool.	Walter Humphreys, 80 Federal Street, Boston, Mass.	Wool textile manufacturers.
American Society of Mechanical Engineers, special research committee on lubrication.	To study the relation between the properties of lubricants and their performance in service.	A. E. Flowers (chairman), The De Laval Separator Co., Poughkeepsie, N. Y.	American Society of Mechanical Engineers.
Building code committee	To formulate and recommend provisions for municipal building code regulations.	George N. Thompson, Bureau of Standards, Washington, D. C.	Architects and engineers.
Central research committee	To advise in general on paper researches	E. Mahler, Kimberly-Clark Corporation, Neenah, Wis.	Paper technologists representing manufacturers.
Certification committee, Horological Institute of America.	Examination and certification of watchmakers.	R. E. Gould, Bureau of Standards, Washington, D. C.	Examining Board, Horological Institute of America.
Committee on investigation of insulating liquids.	To advise on program of research on liquid insulators.	J. L. Hecht (chairman), Public Service Co. of Northern Illinois, Chicago, Ill.	Representatives of electric light and power companies.
Committee on properties of steam and extension of the steam table.	To direct research on the properties of steam and extension of the steam table.	Alexander Dow (chairman), 2000 Second Street, Detroit, Mich.	American Society of Mechanical Engineers.
Ferrous metals advisory committee	To guide bureau in selection of research problems in ferrous metals.	G. B. Waterhouse (chairman), Massachusetts Institute of Technology, Cambridge, Mass.	American Society for Testing Materials; associations of automotive, mining, and metallurgical engineers and foundrymen; and American Society for Steel Treating.
Joint committee on Diesel fuel research	To secure technical data necessary for specification and production of Diesel engine fuels.	W. H. Butler, care of American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, N. Y.	Society of Automotive Engineers and American Society of Mechanical Engineers.
Joint steering committee on cooperative fuel research.	To assist in formulating program and defining scope of investigations in connection with cooperative fuel research.	C. B. Veal, care of Society of Automotive Engineers (Inc.), 29 West Thirty-ninth, Street, New York, N. Y.	Society of Automotive Engineers, American Petroleum Institute, National Automobile Chamber of Commerce, Aeronautical Chamber of Commerce of America.
Manufacturers' advisory committee on clinical thermometers.	To standardize specifications for clinical thermometers.	E. F. Mueller, Bureau of Standards, Washington, D. C.	All manufacturers of clinical thermometers.

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Advisory committees—Continued

Name	Purpose	Secretary	Membership
Manufacturers' advisory committee on Fourdrinier wire cloth.	To standardize nomenclature, definitions, kinds, and sizes of wire as a basis for manufacture; physical requirements; and standard practices for the handling, installation, and use of this commodity for paper machines.	G. W. Wray, National Bureau of Standards, Washington, D. C.	All manufactures of Fourdrinier wire cloth.
Manufacturers' advisory committee on vitreous china plumbing fixtures.	To standardize nomenclature, definitions, grading rules, essential dimensions, and types of vitreous china plumbing fixtures.	I. J. Fairchild, Bureau of Standards, Washington, D. C.	All manufactures of vitreous china plumbing fixtures.
Nonferrous metals advisory committee	To guide the bureau in selection of research problems in nonferrous metals.	W. H. Bassett (chairman), American Brass Co., Waterbury, Conn.	American Society for Testing Materials; Government departments; and associations of electrochemical, mechanical, mining, and metallurgical engineers.
Radio advisory committee	To assist in formulating and revising program of research in radio communication.	J. H. Dellinger, Bureau of Standards, Washington, D. C.	Associations of radio engineers, broadcasters, radio and electrical manufacturers.
Research committee of American Association of Textile Chemists and Colorists.	To advise on technical questions dealing with the application and testing of dyes.	L. A. Olney (chairman), Lowell Institute, Lowell, Mass.	Textile chemists and colorists.
Research committee of American Dental Association.	To standardize purchase and use of dental materials.	R. H. Volland (chairman), Iowa City, Iowa.	American Dental Association.
Research committee of American Electroplaters' Society.	To advise on electroplating research	Jacob Hay (chairman), 6920 Ottawa Avenue, Chicago, Ill.	Foreman electroplaters.
Research committee of International Association of Electrotypers.	To advise on electrotyping problems	Harry E. Wise (chairman), Michigan Electrotype & Stereotype Co., 457 Fort Street, West, Detroit, Mich.	Employing electrotypers.
Society of Automotive Engineers' research committee.	To asist (through subcommittees) in formulating programs of research on such problems as automobile headlighting, riding qualities of motor vehicles, automotive fuels and lubricants.	C. B. Veal, c/o Society of Automotive Engineers (Inc.), 29 West Thirty-ninth Street, New York, N. Y.	Society of Automotive Engineers.
Standard State mechanics' lien act committee.	To draft uniform mechanics' lien act for consideration by State legislatures.	Dan H. Wheeler, Bureau of Standards, Washington, D. C.	Architects, lawyers, credit men, and associations connected with building or construction operations.
Subcommittee on methods of measuring detonation.	To develop standard methods of measuring the detonation characteristics of automotive fuels.	C. B. Veal, c/o Society of Automotive Engineers, Inc., 29 West Thirty-ninth Street, New York, N. Y.	Commercial and university research laboratories.
Subcommittee on plumbing, building code committee.	To formulate and recommend provisions for State and municipal regulations of plumbing installations.	George N. Thompson, Bureau of Standards, Washington, D. C.	Sanitary and civil engineers.

OTHER COOPERATIVE ACTIVITIES

Many national organizations assist the bureau in research, standardization, and simplification projects and, in turn, the bureau cooperates officially with numerous national organizations engaged in similar efforts, frequently designating members of the staff to serve on committees.

SOME ACTIVITIES AND ACCOMPLISHMENTS

PRACTICAL APPLICATION

Except for necessary administrative functions, all activities of the bureau are directed toward some phase of standardization, from the pursuit of data to serve as the groundwork or foundation for fundamental standards and master specifications to the final check of delivered material for conformity to specification requirements.

The national standards of length, mass, time, and all the other bases of measurement rest upon scientific data of the highest order. As the technique of the various arts, professions, and trades improves, the standards, which are essential tools of the art, must be further refined and more carefully protected from change. The ideal standard of measurement is one that has been defined in terms of a fundamental constant of nature so as to be easily reproduced in the event of destruction of the physical prototype. Thus the inch, upon which so many of our national standards depend, can be reproduced in terms of the wave length of light with an error of less than 1 part in 1,000,000.

The increasing complexity of our industrial and commercial structure is constantly creating new fields in which standards must be developed. The bureau, therefore, must keep in step with progress in the arts so that standards of measurement may be available as needed.

The results of research are also utilized in the preparation of Federal specifications, and the testing facilities of the bureau aid the Government in checking delivered materials for compliance with specifications. Such research and tests provide the necessary foundations of unchallenged fact for the various standardization activities of the bureau.

Representative activities and accomplishments are listed alphabetically under titles selected in a practical way for the convenience of the reader without any attempt at systematic classification.

AERONAUTICS

Strength of Welded Joints in Tubular Members for Aircraft.—The importance of welding in the aircraft industry will be realized when it is considered that at least 90 per cent of the airplanes manufactured in this country have structural members joined by welding. As comparatively little information on aircraft welding had been available, the bureau, in cooperation with the National Advisory Committee for Aeronautics and the Aeronautics Branch of the Department of Commerce, made an investigation of the strengths of 40 typical joints. The results of this investigation have been published.

A continuation of this investigation is in progress using (1) a type of gusset-reinforced joint shown by previous tests to be the most efficient, (2) joints heat-treated after welding, and (3) joints made from thin-walled tubing.

Publication.—The Strength of Welded Joints in Tubular Members for Aircraft, by H. L. Whittemore and W. C. Bruggeman, National Advisory Committee for Aeronautics, Technical Report No. 348; 1930.

Airship Girders.—The prevailing trend in the design of rigid airships seems to be toward ships having greater displacements. This necessitates larger structural members. An investigation in cooperation with the Bureau of Aeronautics, Navy Department, is in progress for developing the factors affecting the strength and rigidity of girders to furnish analytical methods of design for these very important members of a rigid airship.

A series of compression tests has been made on a large number of airship girders of different sizes. These tests showed that the strength of the girders depended almost entirely upon the different types of the critical instability.

For some sizes and kinds of girders the governing type of instability in the chord members was torsion. In compression tests of short lengths of girders in which the twisting of the chord members alone was restrained, the strength of the girder was increased over 40 per cent.

If practicable designs are found for longitudinal members having high-torsional rigidity, the strength of rigid airships can be considerably increased without increasing the weight.

Fixation of Struts.—Tubular struts of steel and aluminum alloy are used frequently as compression members in the fuselages of airplanes. When so used, the ends are elastically restrained from rotation. In cooperation with the National Advisory Committee for Aeronautics and with the Navy Department a series of chrome-molybdenum steel struts of different lengths and with different end restraints, has been tested in compression. The results should enable designers to reduce the weight of aircraft structures with safety, since the action of elastically restrained ends is now known more definitely.

Investigation of Control Surfaces of Airplanes.—A wind-tunnel study of the hinge moments of ailerons at large angles of attack was completed with the cooperation of the Aeronautics Branch of the Department of Commerce and the National Advisory Committee for Aeronautics.

Measurements of the yawing moments produced by several rudders were made at large angles of attack.

Publication.—Effect of Variation of Chord and Span of Ailerons on Hinge Moments at Several Angles of Pitch, by B. H. Monish, National Advisory Committee for Aeronautics, Technical Report No. 370; 1930.

Measurement of Turbulence.—In cooperation with the National Advisory Committee for Aeronautics, a study has been made of methods of reducing turbulence in wind tunnels. The apparatus has been further improved by extending the frequency range for which the response is uniform to 4,000 cycles per second.

Publication.—Reduction of Turbulence in Wind Tunnels, by H. L. Dryden, National Advisory Committee for Aeronautics, Technical Report No. 392; 1931.

Aircraft Instruments.—Investigations of aircraft clocks, magnetic compasses, sensitive altimeters, and a supercharger pressure gauge, the latter constructed for the purpose, were conducted to provide a basis for specifications of performance. A number of instrument panels with indirect illumination were constructed for use in service tests. An angle-of-attack indicator of new design was constructed for use in further development of methods of flight testing airplanes and a commutator-condenser type air-speed indicator for use in flight testing the autogiro at low speeds. An air-speed recorder was constructed and maximum indicating accelerometers were further developed, both to be used in flight testing airplanes. The construction of a stern mooring force indicator for the airship *Los Angeles*, which is part of the Navy program for improving the handling of airships on the ground, was completed. An extensive investigation of damping liquids for aircraft instruments, as inclinometers and magnetic compasses, was completed. Data are now being obtained on the change in the two elastic moduli with temperature of metals used as elastic elements in instruments.

Publications.—Present Status of Aircraft Instruments, by W. G. Brombacher, National Advisory Committee for Aeronautics, Technical Report No. 371; 1930.

Temperature Coefficient of the Modulus of Rigidity of Aircraft Instrument Diaphragm and Spring Materials, by W. G. Brombacher and E. R. Melton, National Advisory Committee for Aeronautics, Technical Report No. 358; 1930.

Thermometric Lag of Aircraft Thermometers, Thermographs and Barographs, by H. B. Henrickson. B. S. Jour. Research, vol. 5, No. 3, p. 695; 1930.

Investigation of Damping Liquids for Aircraft Instruments II, by M. R. Houseman and G. H. Keulegan, National Advisory Committee for Aeronautics, Technical Report No. 398; 1931.

Altitude Testing of Aircraft Engines.—The program of altitude chamber tests for the Army Air Corps of the Curtiss D–12 engine equipped with gear-driven superchargers was concluded when the centrifugal supercharger having a critical altitude of 15,000 feet at 2,300 revolutions per minute suffered a bearing failure under high-altitude conditions. Subsequent altitude tests of this engine to study the effect of air humidity on power confirmed early altitude laboratory observations that erratic performance and a marked decrease in power are encountered when air of high relative humidity is supplied to the carburetor at temperatures below 15° C.

Publication.—Altitude Laboratory Tests of Aircraft Engines, by H. K. Cummings and E. A. Garlock, Aeronautical Engineering, Trans. Amer. Soc. Mech. Engineers, vol. 3, No. 4; October–December, 1931.

Type Testing of Commercial Airplane Engines.—The airplane engines tested at the Arlington engine-testing laboratory have embraced a wider range of types and sizes. There were 11 radial engines, including 1 Diesel; 8 inverted in-line engines; 4 horizontal-opposed engines; and 4 V-type engines, including a 12-cylinder inverted V. Five engines tested had less than 200 cubic inches displacement and three engines had more than 700 cubic inches displacement. Of 27 engines received for test during the year, 14 passed, 11 failed, and 2 were withdrawn. Eight of the engines which failed were new types

and three had received one previous test each. This work is supported by the Aeronautics Branch of the Department of Commerce.

Publications.—Aircraft Engine Testing, Aeronautics Bulletin No. 12; July 1, 1930.

Gasoline Requirements of Commercial Aircraft Engines, by H. K. Cummings, Soc. Automotive Engineers Journal, vol. 27, p. 212; August 1930.

Reduction of Noise in Airplanes.—In cooperation with the Aeronautics Branch of the Department of Commerce, a set-up has been provided for the study of mufflers for airplane engines.

Crash-Resistant Tanks.—In cooperation with the Aeronautics Branch of the Department of Commerce, a study is in progress of the possibility of making airplane fuel tanks less susceptible to failure in accidents.

AUTOMOTIVE ENGINEERING

Vapor Lock Investigation.—Temperature measurements in airplane fuel systems during flight indicate that many airplanes now in service require gasoline with low vapor pressure to insure freedom from engine stoppage in the air because of vapor lock. The results of laboratory experiments suggest certain improvements in fuel-system design which would permit the use of better fuels.

Similar work with numerous automobiles on the road points to improper design of fuel systems as the major cause of vapor lock. As a result of this investigation extensive changes are being made in forthcoming models which will go far to minimize vapor-lock troubles.

Publications.—The Vapor-Locking Tendency of Aviation Gasolines, by O. C. Bridgeman and H. S. White, Soc. Automotive Engineers Journal, vol. 27, p. 218; August, 1930.

Effect of Weathering on the Vapor-Locking Tendency of Gasolines, by O. C. Bridgeman and E. W. Aldrich, Soc. Automotive Engineers Journal, vol. 27, p. 344; September, 1930.

The Effect of Airplane Fuel-Line Design on Vapor Lock, by O. C. Bridgeman and H. S. White, Soc. Automotive Engineers Journal, vol. 27, p. 444; October, 1930.

A Survey of Current Automobile and Bus Fuel-Line Temperatures, by O. C. Bridgeman and H. S. White, Soc. Automotive Engineers Journal, vol. 28, p. 572; May, 1931.

Automobile Fuel-Line Temperatures and Vapor Lock, by O. C. Bridgeman, Proceedings, First Mid-Year Meeting Division of Refining, American Petroleum Institute, p. 13; April 30, 1931.

Airplane Fuel-Line Temperatures, by O. C. Bridgeman, C. A. Ross, and H. S. White, Soc. Automotive Engineers Journal, vol. 29, p. 121; August, 1931.

Antiknock Characteristics of Fuels.—The problem of measuring the detonation characteristics of motor fuels is nearing solution. The octane number detonation scale has been adopted as the recommended practice of the Society of Automotive Engineers. Approval of the test engine, developed by the fuel-research steering committee with which the bureau is cooperating, is expected to follow completion of final tests now being undertaken. A definite procedure has been tentatively adopted and will be given final form within a few months. English and German detonation committees have adopted the octane number scale and will follow the recommendations of the American committee in other respects.

The objectionable feature of automobile-engine detonation is noise; that of aircraft engines is overheating or mechanical shock. Recog-

nizing this difference, the bureau initiated cooperative research on methods of measuring detonation of aviation fuels. The first symposium on this subject indicated need of such research, the results obtained by different methods being quite diverse.

Publications.—Atmospheric Conditions and Knock Testing, by D. B. Brooks, N. R. White, and H. H. Allen, Soc. Automotive Engineers Journal, vol. 27, p. 56; July, 1930.

Detonation Characteristics of Motor Gasolines, Bureau of Mines, R. I. No. 3092, p. 11; March, 1931.

Progress Toward a Standard Method for Determining the Anti-Knock Value of Motor Fuels, by H. C. Dickinson, Proc., First Mid-Year Meeting Div. Refining, Am. Petroleum Inst., p. 7; April 30, 1931.

Effect of Humidity and Air Temperature on Octane Numbers of Secondary Detonation Standards, by D. B. Brooks, N. R. White, and G. C. Rodgers, Soc. Automotive Engineers Journal, vol. 29, p. 45; July, 1931.

Detonation Characteristics of Motor Fuels, N. R. White, and H. K. Cummings, Bureau of Mines, R. I. No. 3152, p. 12; November, 1931.

Effect of Spark Character on Ignition Ability.—In cooperation with the National Advisory Committee for Aeronautics, the effectiveness of ignition sparks has been compared by determining the amount of chemical reaction when different sparks are passed through lean mixtures of oxygen and hydrogen at atmospheric pressure. The cathode-ray oscillograph is used to identify the electrical characteristics of these sparks.

Work undertaken by the ignition laboratory for the Bureau of Aeronautics of the Navy Department has included (1) measurements of sparking potential and of the distribution of energy in different spark gaps, (2) the use of absorption spectra to study the effect of temperature on the oxidation of hydrocarbon-oxygen mixtures and (3) tests of gasoline stability as influenced by exposure to ultra-violet light.

Publication.—An Investigation of the Effectiveness of Ignition Sparks, by M. F. Peters, W. L. Summerville, and M. Davis, National Advisory Committee for Aeronautics Technical Report No. 359; 1930.

Combustion in an Engine Cylinder.—Theoretical and experimental studies of gaseous explosions in constant volume bombs have been made as aids to the interpretation of recent stroboscopic observations of flame movement and pressure development in an engine cylinder. Preliminary measurements indicate that the progress and character of the explosion in the engine may also be investigated by analysis of the infra-red radiation through fluorite windows in the cylinder head.

Publications.—Flame Movement and Pressure Development in an Engine Cylinder, by C. F. Marvin, jr., and R. D. Best, National Advisory Committee for Aeronautics, Technical Report No. 399; 1931.

An Investigation of Infra-Red Radiation from an Engine, by S. Steele, Nature, vol. 128, p. 185; August, 1931.

Phenomena of Combustion.—Using the soap bubble as a constant pressure bomb, a higher precision is being sought in the determination of final volume than previous workers have been able to attain in their determination of final pressure by manometric means. The object of the present work, in cooperation with the National Advisory Committee for Aeronautics, is to study the relation between ex-

plosion temperature and rate of transformation in homogeneous mixtures of explosive gasses at constant pressure.

Publications.—The Gaseous Explosive Reaction—The Effect of Pressure on the Rate of Propagation of the Reaction Zone and upon the Rate of Molecular Transformation, by F. W. Stevens, National Advisory Committee for Aeronautics, Technical Report No. 372; 1930.

The Gaseous Explosive Reaction, by F. W. Stevens, The Scientific Monthly, 32, p. 556; June, 1931.

Automobile Brakes and Brake Testing.—The safety code for brakes and brake testing, for which the bureau and the American Automobile Association were joint sponsors, is to be revised in view of the wide-spread use of 4-wheel brakes on automobiles. The personnel of the revised sectional committee for this project was approved June 4 by the council of the American Standards Association.

Effect of Air Humidity on Engine Performance.—Extensive tests made for the Bureau of Aeronautics of the Navy Department on various types of engines show that power always decreases as air humidity increases, and lead to the conclusion that the indicated power of an engine at constant air temperature is proportional to dry-air pressure. It is recommended that humidity be recognized as a major factor in engine-power variation; and it is proposed that: (1) Sea-level engine tests be corrected to a total pressure of 760 mm, but a dry-air pressure of 750 mm of mercury; and (2) standard humidities decreasing from 10 mm of mercury at sea level to 0.18 mm at an altitude of 25,000 feet be added to the specifications of the standard atmosphere.

A study of the injection of water spray into the combustion chamber of an engine indicates high antiknock action without loss of power when optimum timing of injection and spark advance is employed. Further research at high-compression ratios is essential.

BUILDING AND HOUSING AND BUILDING CONSTRUCTION

Building Codes.—A report, " Recommended Minimum Requirements for Fire Resistance in Buildings," appeared during the year. This gives suggested classifications of buildings according to their construction and occupancy, describes minimum fire resistive features, and lists materials which have shown a given degree of fire resistance or in the committee's judgment are capable of doing so. Studies of current practice in providing exit facilities for buildings and counts of the rate at which persons can pass through doorways and down stairways have been undertaken as a part of the work of preparing the next report on recommended minimum requirements for egress.

City Planning and Zoning.—Surveys of city planning and zoning in the United States showed an increase in both the number of city-planning commissions established and the number of municipalities having adopted zoning ordinances. A study of State legislation relating to these subjects showed further progress in the use of the recommendations of the advisory committee on city planning and zoning. A study of subdivision control and regulations was begun by this committee. Assistance was rendered by the bureau in furnishing city planning and zoning data to various committees of the President's Conference on Home Building and Home Ownership.

Construction Economics.—Several members of the bureau's staff continued to aid in the department's work of coordinating the activities of Federal, State, and local officials, and expediting public-works construction. This was part of the general program to sustain business and employment activity.

Several members of the staff also aided in carrying on economic and statistical investigations for the President's Conference on Home Building and Home Ownership and for the National Conference on Construction. Work was continued in compiling data for a cyclical analysis of building conditions, especially in compiling building-permits data. A report on the vacancy situation and the different types of dwellings was also compiled and released on May 1. The compilation of retail building-material price data in 51 cities was continued and a report issued each month during the year.

Home Financing.—A preliminary report was prepared on home financing, and work was continued in cooperation with the President's Conference on Home Building and Home Ownership.

Care and Repair of the House.—A book of simple and definite instructions, designed to aid the home owner or householder in keeping his property in the most useful condition, was published in April. The first edition of 15,000 copies was sold in three months, and 50,000 additional copies were printed. Much publicity has been given the book through newspapers, magazines, local stores, and national trade and educational associations.

Cooperation with Other Agencies on Building and Housing Problems.—Cooperation was continued with Federal and State agencies and with local governments and private organizations concerned with building and housing. City planning and zoning, building codes, plumbing standards, fire resistance, and home ownership problems were taken up with bodies, such as Better Homes in America, with its 6,500 local committees and organizations, representing architects, engineers, business, civic, and other groups. Members of the staff have been actively cooperating in the work of the division of public construction, under the direction of the Secretary of Commerce, and in preparations for the President's Conference on Home Building and Home Ownership.

Sound-Proof Partitions.—The investigation of wall and floor structures designed to prevent or minimize the passage of sound from one room to another has been continued. Noises resulting from direct impact with the partition, such as the impact of uncushioned heels of shoes on a bare floor, are transmitted more readily than airborne sounds, and a special study has been made of floor structures designed to minimize such sounds.

Absorption Coefficients of Acoustic Materials.—Numerous measurements have been made of the sound absorption coefficients of acoustic tile, acoustic plaster, and other materials designed to reduce the reverberation time of large rooms. These materials are being used extensively not only to improve the acoustics of auditoriums, but also to reduce the noise level in banks and large offices where many typewriters, accounting machines, and computing machines are used. The development of acoustic correctives has been so active that frequent revision of the tables showing the absorption coefficients of

various materials has been necessary, and consequently the results of the bureau's measurements have been published in the form of mimeographed letter circulars. Three such circulars have been issued during the year, for which there has been a great demand.

Wind Pressure on Structures.—A comprehensive paper on the wind pressure on circular cylinders and chimneys, and another on measurements on a model of a mill building have been published in the Journal of Research.

A model of the Empire State Building to a scale of 1:250 was constructed, and wind-pressure measurements at various levels and speeds up to 60 miles per hour are in progress.

Publications.—Wind Pressure on Circular Cylinders and Chimneys, by H. L. Dryden and G. C. Hill, B. S. Jour. Research, vol. 5, No. 3, p. 653; 1930.
Wind Pressure on Model of a Mill Building, by H. L. Dryden and G. C. Hill, B. S. Jour. Research, vol. 6, No. 4, p. 735; 1931.

Plumbing Investigations.—Investigations, partly financed by the plumbing industry, combining an experimental study of flow in pipes with field observations and measurements on plumbing systems in actual use, are in progress. These investigations, conducted in collaboration with the subcommittee on plumbing of the Department of Commerce Building Code Committee, are expected to supply complete data for determining sizes of drain and vent pipes needed in plumbing installations for all types of structures, including modern tall office, apartment, and hotel buildings. To provide the necessary space and equipment for the experimental study, a tower 100 feet high, surmounted by a 3,000-gallon tank and equipped with pumps and supply pipes delivering about 600 gallons per minute, has been erected at the bureau. This tower and equipment provide for measurements of capacity flow in sloping drains up to 6 inches diameter.

Preliminary field investigations and a thorough examination of the recommendations of the subcommittee, as revised in 1929, indicated the advisability of an immediate revision of those sections of the code relating to drain-pipe sizes. This revision was completed in May, 1931, and the revised sections are being printed as a supplement to the report of the subcommittee, pending the completion of the present investigations.

CEMENT AND CONCRETE

Durability of Concrete Aggregates.—The average resistance of the commonly used concrete aggregates to the boiling and drying, freezing and thawing, sodium sulphate, and sodium chloride tests was in the following order: Granite, trap, gravel, slag, limestone, and sandstone. Individual samples, however, varied greatly from this order, one sample of limestone being as resistant as the average granite. The absorption and porosity measurements were found to be of little value as criteria for judging the ability of the aggregate to withstand disintegration. Petrographic examination of the specimens enables some poorly resistant materials, such as limestones with large stratified clay deposits, to be identified.

Publication.—The Selection of Durable Aggregate for Concrete, by M. Temin, W. Pigman, and J. Tucker, Rock Products; July 18, 1931.

Clays as Admixtures in Concrete.—The effects on the compressive strength and permeability of concrete of substituting clay, either for 10 per cent of the volume of cement or for 7½ per cent of the volume of the fine aggregate, was studied. The concrete without an admixture contained five sacks of cement per cubic yard of concrete. Three different cements and three clays were used. All were mixed to the same consistency as determined by a penetration test. The clay substitutions affected the average strengths only slightly, but seemed to promote uniformity in the strengths of the individual specimens; the absorption of the concrete was increased slightly by clay admixtures and the permeability was reduced to a small extent.

Tests of the Arlington Memorial Bridge.—The measurements of temperatures and deformations in one of the arch spans of the Arlington Memorial Bridge in Washington, D. C., have been completed. The heat generated by the chemical action of the cement caused the temperature of the thick portions of the arch barrel to rise, within a period of 36 hours, from a temperature of 70° to one of 140° F. A period of about 15 days was required for the concrete to cool to within a few degrees of air temperature. Deflections of the free arch barrel indicated a coefficient of expension of the concrete of about 0.0000065 per degree Fahrenheit. The average temperature of the arch barrel has ranged between 28° and 85° F. in a period of two years. The superstructure consisting of a granite facing, cross walls, and deck had a measurable effect on the deformations of the arch, the effect of the facing being to cause transverse deflections of the arch barrel.

Reaction of Water on Calcium Aluminates and Calcium Aluminate Cements.—From a study of the composition of the aluminate solutions resulting from the reaction of water on a calcium aluminate cement, it has been found that the extent of the reaction is approximately a logarithmic function of the temperature. The fields in which hydrated alumina+hydrated tricalcium aluminate, hydrated in calcium aluminate and hydrated tetra calcium aluminate, respectively, are the solid phases in the system CaO–Al_2O_3–H_2O have been determined. The temperature of inversion of the isometric and hexagonal forms of hydrated tricalcium aluminate is being investigated.

The Decomposition of Tricalcium Silicate at Temperatures Below Its Range of Stability.—It has been found that CaO and $2CaO.SiO_2$ catalyze the decomposition of $3CaO.SiO_2$ into these products and that the rate of decomposition is a maximum at 1,175° C.

Reaction of Water on the Anhydrous Calcium Silicates.—The reaction of water upon anhydrous $3CaO.SiO_2$, β–$2CaO.SiO_2$, and β–$CaO.SiO_2$ has been investigated. It has been found that $3CaO.SiO_2$ and β–$2CaO.SiO_2$, which have hydraulic properties, give metastable silicate solutions which decompose with the precipitation of hydrated calcium silicates. β–$CaO.SiO_2$ gives stable solutions. The pH of the calcium silicate solutions has been found to be a function of the lime in excess of monocalcium silicate if this excess is greater than 0.15 g CaO per liter.

Phase Study of the System $CaO–SiO_2–B_2O_3$.—The composition and melting points of the various anhydrous borates have been determined in the study of the system $CaO–SiO_2–B_2O_3$ relative to the effect of B_2O_3 on the formation and properties of the calcium silicates occurring in Portland cement.

A Study of Merriman's Suggestion for Determining the Durability of Portland Cements.—It was found that the solubility of a cement in sugar solution was not a satisfactory index of its disintegration in sulphate solutions.

Publication.—A study of Merriman's Suggestion for Determining the Durability of Portland Cements, Engineering News Record, vol. 107, No. 4; July 23, 1931.

Properties of Calcium Aluminate Cement Concrete.—Strength, durability, and the temperature rise during hardening were determined on 29 calcium aluminate cements. The investigation was divided into five major studies, viz, the effect on the physical properties, (1) by varying the lime content of the cement in increments of 2 per cent, (2) varying the silica, (3) holding the silica content near the highest allowable limits and varying the lime, (4) varying the iron content, and (5) effect of oxidation or reduction in the burning of the cement. Up to the age of three months optimum properties were obtained when the mineral $5CaO.3Al_2O_3$ in its unstable form predominated and the mineral galenite was absent or present in very minor quantities in the cement.

Crazing of Portland Cement Mortars.—Twenty-four by twenty-four inch concrete slabs made of 1 part cement and 3 parts of various sizes of graded sand were cured three days under varying controlled conditions of temperature and humidity. Temperature ranges were from 70° to 100° F. and the humidity was from 35 to 100 per cent. Duplicate slabs were exposed in the laboratory and on the roof. No crazing developed on the slabs exposed in the laboratory. Practically all of the slabs exposed on the roof showed evidence of crazing. The slabs made at 70° F. and 35 per cent humidity developed the greatest amount of crazing.

Constitution and Hardening of Portland Cement.—The work of the Portland Cement Association fellowship during the past year has been directed primarily to five investigations of major importance: First, a study of the compound formed in the $Ca-Na_2O-Al_2O_3$ system; second, a study of the compound formed in the $CaO-TiO_2$ system; third, the making and testing of cements of rich composition under carefully controlled conditions of manufacture; fourth, a determination of the heat evolved during hardening of the major constituents in Portland cement; and fifth, determining the rate of hydration of carefully sized particles of some of the cement constituents.

Masonry Cements.—An investigation of all the masonry cements on the market is well under way. Workability, plasticity, water-retaining capacity, strength, volume change, and specific gravity of the pastes and mortars are among the properties being studied. The workability of the mortars has been shown to be a function of the plasticity and the water retaining capacity of the cements. The

investigations necessitated the development of special types of apparatus to measure the properties. It is expected that as a result of the data obtained from the completed investigation, the Federal specification for masonry cement will be completely revised.

Cast Stone.—Freezing and thawing tests on cast-stone samples have been continued until the samples showed signs of disintegration. The resistance to freezing and thawing ranged from complete failure in 25 cycles to specimens that showed the first small signs of failure at 1,450 cycles. The average resistance to freezing of the samples made by the wet-cast process was equal to the average resistance of the specimens made by the dry-tamp process. The specimens formed by vibrating showed greater than the average resistances to freezing.

A proposed Federal specification for cast stone has been drawn up and submitted to the industry for comment.

Waterproofing Compounds.—The incorporation of 50 different integral waterproofing compounds in 1:3:6 concrete showed 16 per cent of the compounds to be effective in reducing the permeability of the concrete when it was subjected to a continuous water pressure of 20 pounds per square inch for one year. Inert materials, as fillers, were more effective in reducing permeability than such materials as soap, lime and soap, calcium chloride, and combinations of calcium chloride and soap. Fifty surface waterproofing materials coated on 1:2:4 concrete were less absorbent than uncoated concrete for the first few hours immersion in water. The most efficient coatings after one year immersion were asphalt emulsions and asphalt paints. Linseed oil, China wood oil, and varnish were the most efficient transparent coatings. An informal talk covering the results of these tests was given at the February, 1931, meeting of the American Concrete Institute.

Fineness of Cement.—A study of the effect of fineness on cement is in progress, and there has been developed an air elutriator which will separate cement into clean fractions at the rate of a pound an hour. The fractions are exceptionally free of oversize or undersize particles. Several typical cements will be separated with the elutriator and an extensive series of concrete tests will be made on the individual fractions and upon arbitrary combinations of these fractions. Study will also be made of various methods of determining fineness.

High Early Strength Cements.—An investigation of the properties of high early strength cements is now in progress. Concrete cylinders are made up with a 1:2:4 mix, in three water-cement ratios, viz, 6.5, 7.5, and 8.5 gallons per sack. During the first 24 hours after making, the cylinders are stored under four different conditions: 70°, 90°, and 110° F., and in an insulated box. Temperature changes during the initial 24-hour period are determined by thermocouples in the cylinders. Subsequent treatment of the cylinders consists of air-curing (70° F.), damp curing (70° F.), freezing and thawing, and outside storage. Volume changes are also determined. Results thus far obtained show considerable differences between various cements, in initial temperatures and strength at 24 hours and subsequent ages.

The differences in volume change are not as great. Making and storing at higher temperature during the first 24 hours can generally be expected to increase the one-day strength but may decrease the strength at later ages. The air-cured cylinders thus far tested at the age of one year are often considerably lower in strength than those damp cured. The air-cured specimens also show a shrinkage at least twice as large as the expansion of the damp-cured specimens.

Cement Reference Laboratory.—The cement reference laboratory, a cooperative project of the Bureau of Standards and the American Society for Testing Materials, has continued its efforts to secure improvement in cement testing. During this second year the laboratory has again concentrated upon field work, and has revisited many laboratories for the second time. During the year there were received requests for inspection of 217 laboratories, of which about 60 per cent had been previously inspected. The reinspections, in general, show improvement in both methods and apparatus. The data collected in this field work have proved valuable in the laboratory's activities, and have directed attention to numerous points deserving study.

Branch Laboratories and Inspection of Cement.—Branch laboratories are maintained at Northampton, Pa., Denver, Colo., and San Francisco, Calif. All laboratories test cement, the Denver laboratory tests concreting materials, and the San Francisco laboratory makes miscellaneous chemical and physical tests. During the past year equipment for the testing of textiles, rubber, and leather was installed at the San Francisco laboratory, and a 4,000,000-pound precision hydraulic-compression testing machine, the largest in the United States outside of the bureau in Washington, was installed at the Denver branch laboratory. Cement inspection service was established at nine additional mills. During the year 2,311,461 barrels of cement, an increase of 42 per cent over the past year, were sampled and 1,829,983 barrels were shipped. The extensive program of Government building has been responsible for a large increase in the amount of testing.

CERTIFICATION AND LABELING

Facilitating the Use of Specifications.—In order to facilitate the use of Federal specifications by agencies making purchases out of tax moneys, Federal, State, county, and municipal, there have been compiled for the use of these agencies lists of sources of supply of commodities guaranteed to comply with the specification requirements. During the year the number of lists has been increased from 271 to 335, the number of requests for listing from 8,175 to 13,267, and the number for firms registered on the lists from 2,892 to 5,161. There have also been compiled 11 lists of willing-to-certify manufacturers of commodities guaranteed to comply with certain commercial standards. The number of these lists has been increased from 10 to 21; the number of willing-to-certify firms from 199 to 628, and the number of requests for listing from 233 to 689. The total number of

requests for listings is 13,956, received from 5,789 firms as shown in the accompanying table:

Statistical summary of willing-to-certify lists as applied to Federal specifications and commercial standards

Commodity groups	Total number of—		
	Specifications	Listings	Firms
Abrasives and polishing materials	9	113	54
Brick	2	596	596
Brushes and brooms	48	945	179
Builders' hardware	1	33	33
Cement, Portland	1	69	69
Cotton gauze and bandages	5	34	11
Dental and surgical supplies	1	16	16
Electrical supplies	14	220	153
Fire extinguishers and liquids	3	78	51
Floor coverings	5	32	19
Glass	1	52	52
Goggles and helmets	7	58	14
Heat-insulating materials	8	58	30
Inks	6	114	43
Insecticides	3	28	18
Leather goods	4	103	81
Lime and plaster	4	145	87
Liquid-measuring devices	1	21	21
Lumber	2	3,142	1,850
Masonry cement and concrete materials	5	76	71
Nonferrous metals	32	1,221	327
Office supplies	8	72	57
Packing and gaskets	13	162	66
Padlocks	1	17	17
Paints and paint materials	29	3,004	305
Paper	28	557	126
Pipe and pipe fittings	7	83	64
Refractories	3	108	60
Ribbons, typewriter	3	93	36
Road and paving materials	7	121	48
Roofing, bituminous, and waterproofing	16	571	106
Rope, wire	1	15	15
Rubber matting	1	13	13
Safes, burglar-resisting	1	3	3
Scales, railroad track	1	7	7
Scales, weighing	1	33	33
Screws, wood	1	14	14
Soaps and scouring compounds	13	562	158
Tableware, silver-plated	1	7	7
Textiles	33	598	191
Towels	1	12	12
Tubing, metallic	4	61	49
Commercial standards	21	689	628
Total	356	13,956	5,789

Facilitating the Marketing of Specification-Made Goods.—A rapidly increasing interest has been shown by organized producers and consumers, and by individual manufacturers and purchasers, in the application of the self-identifying quality-guaranteeing labeling system. Certain manufacturers have stated that they are now using or planning to use quality-guaranteeing labels, or their equivalent, with goods manufactured to comply with Federal specifications for brooms; dental alloys; dry cells; fireproof safes; gypsum; ink (writing, colored, and indelible); library paste; lime; linoleum;

lumber; paint; paper (correspondence, carbon, blue-print, and brown-print); pipe; Portland cement; rope; soap; textiles; and wall board.

At the general conferences of the industries giving consideration to proposed commercial standards, attention is directed to the essential and significant features of not only the certification plan, but also the labeling plan. Manufacturers desiring to do so are encouraged to identify by suitable labels such of their commodities as they are willing to guarantee as complying with certain designated commercial standards. Labels, many of them underwritten by the trade associations, are now being used in connection with commodities complying with commercial standards for aromatic red-cedar closet linings; diamond-core drill fittings; brass, steel, and wrought-iron pipe nipples; feldspar; men's pajamas; plate-glass mirrors; red-cedar shingles; staple porcelain and vitreous plumbing fixtures; Stoddard solvent; wall paper.

Effective use is also being made of labels to identify commodities manufactured to comply with simplified practice recommendations relating to the elimination of excess sizes and varieties of certain staple commodities, and the establishment of standards for such sizes and varieties as are in most common use, including: Abrasives, binder's board, composition books, hard-fiber and soft-fiber twine, lumber, kraft sealing tape, metal lath, grocers' paper bags, school furniture colors, tile, tissue paper, and woven wire fencing. In several cases the labels are issued in the name of the interested trade associations.

A recent survey has shown that nearly 100 trade associations and similar organized groups are making use of labels or their equivalent to identify or guarantee commodities complying with their specifications, many of which are identical with or in complete harmony with Federal specifications, commercial standards, or simplified practice recommendations.

Publications.—Cooperation of the Bureau of Standards with Trade Associations, by A. S. McAllister, Bull., Washington Trade Assn. Executives; March, 1931.

Making Standards Effective, by R. A. Martino, Comm. Stds. Monthly, p. 221; January, 1931.

American and Foreign Standardization on a National Basis, by S. B. Detwiler, jr., Comm. Stds. Monthly, p. 294; March, 1931.

CHEMICALS

Chemical Testing and Methods of Analysis.—Improved test methods were developed, as, for example, those for the determination of carbon in high-sulphur steels; for determining magnesium in Portland cement; for measuring particle size in samples of certain metallurgical materials; and for the precipitation and ignition of magnesium ammonium phosphate.

Publications.—Determination of Carbon in High Sulphur Steels by Direct Combustion, by H. A. Bright and G. E. F. Lundell, B. S. Jour. Research, vol. 5, p. 943; 1930.

Determination of Magnesium in Portland Cement and Similar Materials, by J. C. Redmond and H. A. Bright, B. S. Jour. Research, vol. 6, p. 113; 1931.

The Importance of Particle Size in Samples of Certain Metallurgical Materials, by J. A. Scherrer and G. E. F. Lundell, B. S. Jour. Research, vol. 5, p. 891, 1930.

The precipitation and Ignition of Magnesium Ammonium Phosphate, by J. I. Hoffman and G. E. F. Lundell, B. S. Jour. Research, vol. 5, p. 279; 1930.

Specifications for Analytical Reagent Chemicals.—The bureau's work in this field takes the form of cooperation with the American Chemical Society's committee on analytical reagents.[2] The bureau's share in the work has been the critical study of many of the methods of test which are to be prescribed in the specifications. Specifications for 10 chemical reagents were published in 1931,[3] and about an equal number completed for publication early in 1932.

Distribution of Standard Samples.—During the year 6,506 samples were distributed, having a sales value of $14,433.50, and approximately $14,400 worth of standard samples were added to the salable samples on hand. Among these were new standard samples of soda-feldspar, manganese steel and 18–8 chrome-nickel steel (KA2–S). The standard samples include ores, ceramic and metallurgical products and pure chemicals, and are used to check methods of chemical analysis that control the manufacture and sale of metallurgical, ceramic, and agricultural products, to calibrate scientific instruments and to further research in methods of analysis. A direct result of the use of the samples is a saving of thousands of dollars a year through improved manufacturing operations and the avoidance of costly disputes based on faulty analyses.

CLAY AND SILICATE PRODUCTS

Factors Affecting the Crazing of Earthenware.—This investigation has been extended to include individual ceramic raw materials and a study of the effect of particle size. Data obtained indicate particle size to be an important factor and the relative reaction of various materials is shown by the following values: Feldspar 2.5, lepidolite 1.6, Cornwall stone 1.4, clay 0.4, flint, 0.05. Since it would be impracticable to replace feldspar entirely with one or more other fluxes, and since data on commercial ware show a fairly direct relation between porosity and moisture expansion, it would seem logical to correct susceptibility of earthenware to crazing by lowering the absorption.

Publications.—Technical News Bulletin No. 161, p. 91; September, 1930.
Technical News Bulletin No. 167, p. 27; March, 1931.

Cutlery Marking of Chinaware.—A final report has been published and contains data of sufficient significance to justify the careful control or elimination of sulphur in decorating kiln atmospheres as a means of preventing the manufacture of glazed ware susceptible to metal marking.

Publications.—Cutlery Marking of Chinaware, Technical News Bulletin No. 167, p. 28; March, 1931.
Metal Marking of Whiteware Glazes as Influenced by Sulphur and Carbon in Kiln Atmospheres, by R. F. Geller and A. S. Creamer, J. Am. Ceramic Soc., vol. 14, No. 9; September, 1931.

Feldspar and Its Effect in Pottery Bodies.—The results obtained in this study showed that the feldspars investigated had no discernible

[2] See report of American Chemical Society. This volume, p. 297.
[3] Recommended Specifications for Analytical Reagent Chemicals. W. D. Collins et al., Ind. Eng. Chem (Analytical ed.), 3, p. 221; 1931.

effect on the firing behavior, or color by reflected light, of white-ware bodies; translucency increased with the percentage of K_2O; mechanical strength was influenced more by heat treatment and manner of forming than by the feldspar; the thermal expansions of the bodies were highest for those containing the high soda feldspars; also, slowly cooled semivitreous bodies showed the highest expansions irrespective of the rate of heating.

Publication.—Investigation of Feldspar and Its Effect in Pottery Bodies. by R. F. Geller and A. S. Creamer, J. Am. Ceramic Soc., vol. 14, No. 1, p. 30; January, 1931.

Special Low-Fire White-Ware Bodies.—With the depelopment of means for heating electrically, the attention of the ceramic industry has been turned to the possibilities of adapting this source of heat to the firing of white ware. A study was undertaken to determine the possibilities of maturing white ware at or below 1,000° C. For the preliminary work 28 glasses, or frits, were prepared of which six were found suitable for intensive study. Specimens were made successfully by the dry-press and casting processes and were glazed and matured at 950° C. The bodies developed transverse strengths (expressed as modulus of rupture) varying from 2,800 to 5,000 lbs./in.^{2}

Study of Refractories.—An apparatus and furnace were built for determining the moduli of rupture and elasticity and plastic flow of refractories at temperatures as high as 1,350° C. Preliminary data obained at 1,250° C., of 17 different brands of fire-clay brick, show the modulus of elasticity to range from 70,000 to 300,000 lbs./in.^{2}, and the modulus of rupture from 50 to 670 lbs./in.^{2} The bricks having either a very high alumina or silica content show much lower plastic deflections than do bricks having an approximately equal mixture.

Decided differences were found in the specific gravity, porosity, and linear thermal expansion of five kaolins, representing important world sources, after firing at six different temperatures ranging from 1,150° to 1,500° C. X-ray diffraction patterns established that the high rate of thermal expansion occurring in most clays between 100° and 200° C. is governed by the percentage of cristobalite present.

Twenty-three brands of fire-clay brick were tested for resistance to thermal spalling in accordance with the standard method promulgated by the Federal Specifications Board, the method prescribed by the American Society for Testing Materials, and according to four methods which were modifications of these two standards.

Publications.—Fire Clays. Some Fundamental Properties at Several Temperatures, by R. A. Heindl and W. L. Pendergast, B. S. Jour. Research, vol. 5, No. 2, p. 213; 1930.

Comparative Tests for Determining Resistance of Fire-Clay Brick to Thermal Spalling, R. A. Heindl. Proc. Am. Soc. for Testing Materials; 1931.

Thermal Dilatation of Special Refractories From 20° to 1,800° C.—Determinations of the thermal expansion characteristics before and after heating to 1,700° C. or higher have been made on California magnesite, silica brick, and Rhodesian, African, Grecian, and Indian chrome ores. The expansion below 1,000° C. of the chrome ores is much greater under reducing conditions than under neutral or oxidizing.

Problems Relating to Saggers.—Data obtained on small saggers and specimen bars prepared from each of 35 laboratory-prepared sagger bodies, and 10 commercially prepared sagger bodies, fired at from 1 to 3 different temperatures (1,190°, 1,230°, and 1,270° C.) gave the following information:

1. Increases in the temperature of firing, although evidenced by comparatively small decreases in porosity, may produce great increases in the modulus of elasticity which affects the maximum fiber elongation unfavorably and thereby causes decreased resistance of saggers to thermal shock.

2. The linear thermal expansion changed with increase of temperature of firing, but such changes were not consistently either in the same direction or of the same magnitude. A total linear thermal expansion from 20° to 250° C. of as much as 0.18 per cent practically precluded the possibility of obtaining saggers having a high resistance to thermal shock.

3. Coarse-grogged bodies had decidedly greater plastic deflection at 1,000° C. than fine-grogged bodies. The plastic flow decreased with increase of temperature of firing and also increased with increased flux content.

Survey of Common Brick.—In cooperation with the Common Brick Manufacturers Association, samples of bricks from 220 plants are being tested. The samples from most plants include bricks of three or more grades representing wide ranges in their firing treatment. Tests for compressive strength, transverse strength, absorption and efflorescence have been completed on 85 per cent of the samples. The compressive strengths of the bricks have ranged between 800 and 28,000 lbs./in.^{2} and the water absorption by the 5-hour boiling method between 0 and 35 per cent of the dry weight, but those of one grade from one plant were quite uniform in their physical properties.

Bond Between Mortar and Brick.—Specimens, each consisting of two bricks with a mortar joint between them, were tested to determine the strength or durability of the bond between the mortar and the bricks. Five different makes of bricks and two types of mortar were used. Some of the specimens were aged for six months either in dry storage, damp storage, or exposed outdoors, and then tested for strength. The others were subjected to 50 cycles of freezing and thawing while saturated. Failures of the bond between mortar and brick were not due to the disintegration of the brick or mortar. The absorption properties of the bricks did not have a large effect on the strength or durability of the bond, provided the rapidly absorbing bricks were dampened before placing the mortar.

Publication.—Durability and Strength of Bond between Mortar and Brick, L. A. Palmer and J. V. Hall, B. S. Jour. Research, Vol. 6, No. 3, p. 473; 1931.

Volume Changes in Brick Masonry Materials.—Volume changes in bricks and mortars attending variations in moisture content and temperature were measured. There were included 8 makes of clay brick, 21 cements including Portland and masonry cements, and 7 limes. Volume changes due to temperature variations were usually somewhat greater in the mortars than in the bricks, but the difference was less than might be caused by variations in moisture content. The initial shrinkage during the first two days was greater for the

lime mortars than for the Portland cement mortars. Alternate wetting and drying of lime mortars produced an expansion of some and practically no change in others, whereas, the cement mortars expanded when wet and contracted when drying. There was a wide variation in the volume changes of mortars made with masonry cements. Calcium stearate admixtures in mortars caused a reduction in the rate of expansion and contraction, but did not reduce the total amount of the volume changes either during or subsequent to hardening.

Publication.—Volume Changes in Brick Masonry Materials, by L. A. Palmer, B. S. Jour. Research, vol. 6, No. 6, p. 1003; 1931.

Resistance of Metals to the Abrasive Action of Plastic Clay.—Nineteen metals and alloys have been tested under conditions simulating the stiff-mud process for molding clay products. The relation between abrasion loss and extrusion pressure which has been determined is expressed by the equation:

$$\frac{y^n}{x} = c$$

in which y=abrasion loss and x=extrusion pressure. "x" is influenced by the amount of water "w" in the clay, and by the diameter "d" of the circular orific of the die which gradually increases due to abrasion. These relations have also been determined and are expressed by the following equations:

$$wx^r = k$$
$$d^2x = e$$

The resistance to abrasion of the different types of metals and alloys tested is given in the following order:

1. Chrome-cobalt-tungsten compositions.
2. Carbon-cobalt-chrome-molybdenum steels.
3. Vanadium steels.
4. High carbon steels.
5. Cast-irons.
6. Rustless steels.
7. Copper.
8. Soft brass.

Properties of Architectural Terra Cotta.—In cooperation with the National Terra Cotta Society, the investigation of terra cotta was continued. Several buildings were inspected to determine what defects are developing on terra cotta in service. Laboratory research has continued for improving the quality of terra cotta by better manufacturing methods and to improve methods of setting the material in the building.

Methods of measuring the strength, absorption, and resistance of terra cotta to freezing, spalling, and crazing were standardized, and tentative specifications for terra cotta were prepared. Research for ascertaining why some glazes are more resistant to "moisture crazing" than others revealed the fact the certain glazes expand, because of the action of water in a manner similar to some of the bodies to which they are applied.

Publications.—Method of Measuring Strains Between Glazes and Ceramic Bodies, by H. G. Schurecht and G. R. Pole, B. S. Jour. Research, vol. 5, No. 1, p. 97; July, 1930.

Moisture Expansion of Glazes and Other Ceramic Finishes, by H. G. Schurecht and G. R. Pole, B. S. Jour. Research, vol. 6, No. 3, p. 457; March, 1931.

Columbus Laboratory.—A new major investigation was started during the year of the glassy bond developed in fired ceramic materials. The method of attack is by way of syntheses of the glasses likely to be formed and then a determination of significant properties of these glasses.

In the case of both the English china clays and the Ohio heavy clays a large amount of work was carried out in making colloidal separates and studying their properties, together with a determination of the replaceable bases present, and their influence on the properties of the clays. Some general correlations are developing, but much more data and checkwork are desirable.

A number of commercially ground feldspars were heated under vacuum over the temperature ranges between 0° and 1,200° C. The gases given off were analyzed both quantitatively and qualitatively. In general, water vapor constituted the main bulk of the gases, with much smaller amounts of acid and other gases. Feldspars showing relatively large amounts of acid gases fused with greater opacity than those containing lesser amounts. This work has been prepared for publication.

A number of new points were located in the multiple component system involved in the thermochemical reaction of slags and clay refractories of boiler furnace settings. The method developed for simulating such conditions in the quenching furnace was applied in the study of a number of commercial installations and the description of the method, together with the results obtained was prepared for publication.

Publication.—Action of Slags on Firebrick and Boiler Settings, by T. A. Klinefelter and E. P. Rexford, Trans. of the Am. Soc. Mech. Eng., Fuels and Steam Power Section; 1931.

COLORIMETRY AND PHOTOMETRY

Transformation of Color-Mixture Data.—Methods for the determination of trilinear coordinates of color by visual photometric measurements have been improved; also methods of computing dominant wave length and colorimetric purity. Experimental data by Wright on equivalent color stimuli have been transformed so as to be more readily comparable with previous data. Methods of expressing tolerances in color specifications have been worked out.

Publications.—Interpolation of the O. S. A. "Excitation" Data by the Fifth-difference Osculatory Formula, by D. B. Judd, B. S. Jour. Research, vol. 7, No. 1, p. 85; July, 1931; J. Opt. Soc. Am., vol. 21, p. 531; September, 1931.

Comparison of Wright's Data on Equivalent Color Stimuli with the O. S. A. Data, by D. B. Judd, J. Opt. Soc. Am., vol. 21, p. 699; 1931.

Standardization of Lovibond Glasses.—This has been actively continued, and methods of measurement improved. Two hundred and forty red glasses (making a total of 1,807 since January 1, 1928) were calibrated for use with 35-yellow, as in the vegetable-oil industry. Attention is now being given to standardization of the glasses in other connections urgently demanded.

Standards for Railway-Signal Glasses.—Although the bureau has made spectrophotometric tests of railway signal glasses for many years, the standard glasses established by the American Railway

Association have heretofore been in private custody. These are now being transferred to the bureau.

Standard Glass Filters for Testing Spectrophotometers.—The rapidly increasing industrial use of spectrophotometers makes the establishment of this service a matter of urgent importance. Preparations have been made to issue filters of certified spectral transmission, which may be used to standardize the performance of spectrophotometers.

Maintenance of Unit of Candlepower.—At the present time the international candle is maintained at the Bureau of Standards by means of 45 carbon-filament incandescent electric lamps. The color temperature of the filaments when operated is approximately 2,080° K., corresponding to an efficiency of about 4 watts per candle. The total candlepower of the lamps is 768.34 candles, giving an average value for the 45 lamps of 17.074 international candles.

In May, 1930, there were sent to the Central Chamber of Weights and Measures, Union Socialist Soviet Republics (Russia) the Electrotechnical Laboratory, Japan, the Laboratoire Central d'Electricite, France, the National Physical Laboratory, Great Britain, and the Physikalisch-Technische Reichsanstalt, Germany, groups of six carbon lamps that had been standardized at the Bureau of Standards in terms of the lamps by which the international candle is here maintained, with the request that these lamps be measured in terms of the lamps by which each laboratory maintains the international candle at carbon filament color temperature, that is, 2,080° K.

All the laboratories very courteously responded to this request and made the measurements. The results [4] of these international measurements show that (1) the units as maintained at the Bureau of Standards and at the National Physical Laboratory are in agreement, within the limits of experimental error; (2) the international candle as maintained in France is about 1 per cent larger than the candle as maintained at the National Physical Laboratory and at the Bureau of Standards; (3) the value of the international candle, computed from measurements in Hefner Kerze at the Reichsanstalt is smaller by more than 1 per cent than the candle at the National Physical Laboratory and at the Bureau of Standards.

In order to make the further measurements required to establish the precise relations now existing between the units in use, a group of 12 lamps that have shown themselves to be very constant in output has been sent abroad to be measured in turn at the National Physical Laboratory, the Laboratoire Central d'Electricite, and the Physikalische-Technische Reichsanstalt, and to be returned to the Bureau of Standards for remeasurement.

COMMERCIAL STANDARDS

Progress During the Year.—Commercial standards cover standards of grade, quality, measurement, tolerances, or other consumer criteria established voluntarily by industry as a basis for marketing and certifying various commodities.

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[4] Apart from those countries which do not maintain an independent standard.

Eleven general conferences were held, covering the following subjects: Mop sticks; seats for water-closet bowls; cotton-fabric tents, tarpaulins, and covers; colored sanitary ware; red cedar shingles; knit underwear (exclusive of rayon); bag, case, and strap leather; plywood; Fourdrinier wire cloth; circular flat-knit rayon underwear; and steel bone plates.

A satisfactory majority of acceptances were received, according to estimates from industries concerned, and the success of the following 11 projects has been announced: Aromatic red-cedar closet lining; plate glass mirrors; boys' blouses, button-on waists, shirts, and junior shirts; wrought-iron pipe nipples; cotton-fabric tents, tarpaulins, and covers; staple seats for water-closet bowls; colors for sanitary ware; cotton cloth for rubber and pyroxylin coating; red cedar shingles; knit underwear (exclusive of rayon); and mop sticks.

The 12 following commercial standards were issued in printed form: Interchangeable ground-glass joints, CS21–30; staple vitreous china plumbing fixtures, CS20–30; special screw threads, CS25–30; standard screw threads, CS24–30; feldspar, CS23–30; plain and thread plug and ring gage blanks, CS8–30; builders' hardware (nontemplate), CS22–30; aromatic red-cedar closet lining, CS26–30; mop sticks, CS2–30; plate-glass mirrors, CS27–30; boys' blouses, button-on waists, shirts, and junior shirts, CS14–31; and wrought-iron pipe nipples (first revision), CS6–31. This makes a total of 27 commercial standards published to June 30, 1931.

Surveys of adherence are made periodically. The table shows the results of such surveys completed during the fiscal year.

Adherence to commercial standards

Item	Period covered by survey	Number of manufacturers reporting	Unweighted adherence
			Per cent
Fittings, diamond-core drill, CS17–30	Year, 1930	6	14.3
Hardware, builders' template, CS9–29	First 8 months of 1930	14	60.5
Oils, domestic and industrial fuel, CS12–29	do	29	77.0
Pajamas, men's, CS15–29	Year, 1930	9	92.8
Patterns, dress, CS13–30	First 11 months of 1930	10	89.5
Pipe nipples, brass, CS10–29	Year ending June 30, 1930.	13	100.0
Pipe nipples, steel, CS5–29	Year, 1930	23	93.7
Pipe nipples, wrought-iron, CS6–29	Year ending June 30, 1930.	12	100.0
Porcelain (all-clay) plumbing fixtures, CS4–29	do	6	95.0
Shafts, hickory, golf, CS18–29	Year, 1930	9	53.9
Stoddard solvent, CS3–23	First 8 months of 1930	11	80.8
Unions, standard weight malleable iron or steel, screwed, CS7–29.	do	6	66.7
Wall paper, CS16–29	First 6 months of 1930	16	70.1
Yarns, regain of mercerized cotton, CS11–29	Year ending June 30, 1930.	10	100.0

DENTAL MATERIALS AND METHODS

Cooperation with American Dental Association.—In cooperation with the American Dental Association tests have been completed on amalgam alloys and investment materials. Many valuable contacts (personal and through correspondence) with the profession have been established. Lectures, clinics, and conferences have been held

before approximately 30 groups with a combined or total attendance of over 3,000 dentists. Tentative specifications are now available for investments, inlay waxes, impression compounds, and inlay gold alloys.

The profession is continuing its grant for the support of two research associates and for the purchase of materials for testing purposes.

Supplies tested for Government use have been of better quality than during the preceding year, and rejections have been fewer than at any time in the past.

Publications.—Research Appreciated by the Profession, by Wilmer Souder, Proc. Iowa State Dental Society, vol. 16, p. 81; 1930.

Problems of Dental Research, by Wilmer Souder, J. of Dental Research, p. 547; October, 1930.

Amalgam Technics, by N. O. Taylor, J. Am. Dental Assn., vol. 17, p. 1880; October, 1930.

Inlay Technics, by N. O. Taylor and Geo. C. Paffenbarger, J. Am. Dental Assn., vol. 17, p. 2058; November, 1930.

Inlay Casting Investments—Tentative Specification, by N. O. Taylor, Geo. C. Paffenbarger, and W. T. Sweeney, J. Am. Dental Assn., vol. 17, p. 2266; December, 1930.

Impression Compound—Tentative Specification, by N. O. Taylor, Geo. C. Paffenbarger, and W. T. Sweeney, J. Am. Dental Assn., vol. 18, p. 53; January, 1931.

Course on the Physical Properties of Dental Materials.—A group of dentists, three from the U. S. Army and five civilian dentists from Washington, D. C., attended a course of lectures and experiments on the testing of dental materials. This course was given at the bureau by members of the staff and research associates of the American Dental Association, once a week from July 15 to August 26, inclusive.

The lectures dealt with the methods used in making tests of the physical properties of dental materials and the reasons for making these tests. The dentists in this course carried out a series of 12 experiments on the testing of amalgams, gold alloys, investments, waxes, and impression compounds.

The principal object was to train a number of dentists to assist a cooperative committee of the American Dental Association and the Bureau of Standards in presenting a clinic at the annual meeting in Memphis, October 19–23, 1931.

ELECTRICAL UNITS AND MEASUREMENTS

Ratio of International Electrical Units to Absolute Units.—A complete set of measurements have been made with two different sets of coils in the Rosa-Dorsey-Miller current balance to determine the value of the international ampere in absolute units. These measurements show

1 absolute ampere=1.00003 international ampere

as maintained at the Bureau of Standards by means of standard resistances and standard cells. This result is subject to slight corrections which will probably be less than one in the last significant figure.

Measurements have been completed on a porcelain inductance standard from which the ratio of the absolute ohm to the international ohm can be determined. The result found was as follows:

1 international ohm=1.00051 absolute ohm

with an uncertainty of 2 or 3 in the last significant figure.

Measurements of the mechanical dimensions of the winding on the quartz cylinder have been nearly completed. These have been made with greater accuracy than the measurements made on the porcelain cylinder.

Measurement of High Voltages and Large Currents.—Preliminary measurements at about 100,000 volts made with the large absolute electrometer indicated an agreement within 0.1 per cent with measurements made by means of a carefully calibrated voltage transformer and an electrodynamic voltmeter. Experience in these measurements showed that the precision could be improved by certain refinements, and most of these have now been incorporated in the apparatus. Further measurements using these improvements are now being made.

There has been a very large volume of current-transformer testing, in spite of which time has been found to work out and install a number of refinements in the testing equipment which materially increase the reliability and speed of this work. The upper limit for alternating-current tests set by the bureau's present motor-generator sets is 6,500 amperes at 60 cycles and 8,000 amperes at 25 cycles.

Properties of Mica.—Data obtained on a considerable number of samples of mica submitted by the United States Bureau of Mines have been analyzed and correlated. The results will be published in the Bureau of Standards Journal of Research in a paper entitled, "Some Electrical Properties of Foreign and Domestic Micas and the Effect of Elevated Temperatures on Micas," by A. B. Lewis, E. L. Hall, and F. R. Caldwell. It is felt that this compilation of data should form a valuable basis for much needed standardization of specifications for mica for various purposes.

Magnetic Testing and Research.—A method for standardizing magnetic permeameters at high values of magnetizing force was developed. The bureau also cooperated in the standardization of methods for testing at low inductions. In the field of magnetic analysis investigations were carried out on the relation between magnetic properties and torsional strength of tool steel. Fundamental data were determined to aid in the interpretation of the results of thermomagnetic analysis, with special reference to the effects of carbide particle size and the tempering of quenched steel.

Publication.—A Method for the Standardization of Permeameters at High Magnetizing Forces, by R. L. Sanford, B. S. Jour. Research, vol. 6, No. 3, p. 255; March, 1931.

FIRE RESISTANCE

General Fire Resistance Requirements.—The introduction of sound in motion-picture projection has made necessary new tests of projectors, screens, and booths, to form bases for revision in safety require-

ments used by Government agencies. Work is in progress on the development of methods for testing wood chemically treated to reduce flammability, the results to serve as a basis for specification requirements. Further tests have been made of automatic fire-detecting systems under the law requiring their installation on passenger vessels, and also on systems proposed for installation in public buildings.

Assistance was given in drafting the fire-resistance sections of the proposed revision of the New York City building code. Experimental work on protections needed to prevent fires from household heating and cooking appliances was completed. Building-code requirements in this particular have shown great variation as between different cities, and it is hoped that the results of the present tests will result in greater uniformity and a reduction in the fire loss from improper installation of such devices.

Fire Prevention and Protection.—The activities in this field have been conducted mainly in conjunction with those of the Federal Fire Council and the National Fire Protection Association. Assistance was given in fire hazard surveys of several Federal building groups and in the preparation of a paper and a committee report on protection of records from fire.

Publications.—Record Protection and Office Equipment, by S. H. Ingberg, Quarterly Nat. Fire Protection Assn., vol. 24, No. 4, p. 410; April, 1931.

Construction, Equipment, and Maintenance of Buildings in Their Relation to Protection of Records (Committee Report), Proc. 35th Annual Meeting, Nat. Fire Protection Assn., p. 227; 1931.

Fire Tests of Welded Steel Floor Construction.—To establish a basis for protection requirements, equipment has been completed and initial tests conducted of a new type of welded steel floor construction. Since the supporting member between beams is a steel plate in place of the usual slab, the equipment was designed for application of fire exposure from above as well as below, the size of floor panels tested being 13½ by 18 feet.

Fire Tests of Partitions.—Experimental work was initiated on a series of fire tests of interior partitions. Sixteen fire endurance or fire and water tests were conducted, some being made at the request of the Steamboat Inspection Service, to determine the suitability of constructions proposed for use as fire-resistive bulkheads in ship construction under the new regulation requiring such transverse bulkheads at intervals of not more than 131 feet (40 m).

GAS ANALYSIS AND SERVICE

Gas Appliances.—The systematic study of the effect of changes in the details of burner design and their relation to the assembly of gas-burning appliances has been continued. Data have been collected on the injection of air into burners by hydrogen and by carbon dioxide (representative of extremes of specific gravity). Other subjects studied include the effect of high burner temperatures upon the properties of flames, especially velocity of flame propagation, backfiring and blowing off of flames; and the effect of increased depth of port on the injection of air and on backfiring; the practicability of determining by means of a single-port burner of stand-

ard design a characteristic number from which the behavior of a gas supply with respect to the operation of appliances may be judged; and the effect of nitrogen in both manufactured and natural gas supplies on the properties of the flames.

Publications.—The Design of Gas Burners for Domestic Use, B. S. Circular No. 394, and Am. Gas J., vol. 134, p. 54; May, 1931; vol. 134, p. 35; June, 1931, and vol. 135, p. 37; July, 1931.

"Liquefied Petroleum ('Bottled') Gases," B. S. Letter Circular No. 292. Also published by Western Gas, p. 36; February, 1931; and p. 64; April, 1931, under the title, "Bottled Gases, Their Manufacture, Properties and Uses."

Gas Analysis.—Several improvements have been made in the apparatus and methods employed for the analysis of gases, and these, together with other developments of recent years, have been incorporated into complete analytical units of superior accuracy and convenience. The commercial production of the new models has been undertaken by three of the larger apparatus companies. Other subjects of research during the year include the development of a relatively small and simple apparatus for the fractionation of hydrocarbon gases; the development of an apparatus for the detection of fuel gas in manholes and conduits, in test holes made to locate leakage from mains, etc., and the reagents used for the determination of illuminants, especially fuming sulphuric acid.

Publications.—An Improved Apparatus and Method for the Analysis of Gas Mixtures by Combustion and Absorption, by G. M. Shepherd, B. S. Jour. Research, vol. 6, No. 1, p. 121; January, 1931.

Common Errors in Gas Analysis and Their Remedies, by G. M. Shepherd, American Gas J., vol. 134, pp. 49–52 and 67–73; 1931.

Calculating Gas Heating Value from Analysis, Am. Gas J., vol. 135, p. 42; 1931.

Service Standards for Gas.—The existing State regulations for gas utilities have been completely summarized. Abstracting the local service standards, both voluntary and required, of several hundred gas companies and municipalities has been partially completed. Both these summaries will be included in the next edition of the bureau's circular "Standards for Gas Service." An incomplete study has been made of the economics of the practice of "reforming" gases of high heating value to reduce their heating value before delivery. Much study and consulting work has been devoted to the improvement of existing standards for the control of heating value, meter testing, pressure control, the uniformity of the gas supplied, and service extensions.

Publications.—Should Fuel Gas be Sold by the Heat Unit? by E. R. Weaver, Gas Age Record, vol. 66, p. 571; October 11, 1930.

"The Thermal Basis for Fixing the Price of Gas," by E. R. Weaver, address before Illinois Gas Association. Printed by the association.

Preparation of Pure Oxygen.—This project, in connection with the international comparison of the low temperature scale, required the design and construction of elaborate apparatus for the purpose and resulted in a product of exceptional purity even for such a purpose.

Cooperation With Other Organizations.—The bureau has cooperated with the American Gas Association through service on six technical committees and by furnishing data on methods of test and performance of certain types of appliances, on the corrosion of materials used in the construction of gas appliances, and on other technical subjects. Much time has been devoted to the proposed revision of the gas-fitting regulations of the District of Columbia and to the revision of the rules of the National Fire Protection Association relating to the same subject. The results of the bureau's work in these fields will be found in the publications of the organizations referred to as issued.

GLASS AND VITREOUS ENAMELS

Production of Optical Glass.—Thirty pots, embracing five kinds of optical glass, were melted. Approximately 38,000 blanks for optical elements, weighing 3,001 pounds, were made for the Navy Department. It was shown that satisfactory borosilicate crown glass can be made in 14 hours as compared with 22 hours ordinarily used.

Viscosity of Optical Glass.—Experimental work has been completed and additional and more reliable viscosities are as follows:

Kind of glass	Index of refraction	Viscosity (poises) at					
		900° C.	1,000° C.	1,100° C.	1,200° C.	1,300° C.	1,400° C.
Light crown	1.524	148,500	20,180	3,730	1,035	360	150
Barium flint	1.605	----------	8,000	1,500	385	140	76
Light barium crown	1.574	90,200	6,610	870	225	87	57
Borosilicate crown	1.517	----------	2,510	560	135	85	50
Medium flint	1.620	----------	2,040	585	215	105	65
Dense flint	1.650	6,610	1,530	460	185	88	47

Density, Refractivity, Thermal Dilatation, and Composition of Glass.—Data obtained from 92 experimental glasses indicate that straight-line relations exist between composition, density, and refractivity for the soda-silica, soda-lime-silica, and potash-silica glasses. As an example, the specific volume (reciprocal of density) of the soda-silica glasses can be computed, with an average deviation of 8×10^{-4}, from $V=a_1A+b_1B$; in this, A and B are the percentages of silicia and soda, and a_1 and b_1 have the following values in the indicated silica ranges:

Silica range	a_1	b_1
Per cent		
50 - 59.4	0.0042520	0.0035370
59.4- 66.3	.0043028	.0034628
66.3- 74.9	.0043922	.0032872
74.9-100	.0045400	.0028460

Since in this case, and also in the case of refractivities, the limiting silica values closely approximate the silica content of definite

molecular soda-silica compounds, the evidence suggests that at least some properties of binary glasses may be functions of certain simple compounds.

The thermal expansions of 54 of the soda-silica-lime glasses have been determined, and the following equations can be used to compute their expansivities in the indicated temperature ranges:

$$E(50° \text{ to } 350°) = e_1 - e_2;\ E(350° \text{ to } T_c) = e_3 - e_4;\ N = B + C$$

$$e_1 = (0.57 - 0.21T)N + (0.00229 - 0.005745T + 0.000705T^2)N^2$$

$$e_2 = 0.8T - (0.09 - 0.24T)C$$

$$e_3 = (0.57 - 0.21T)N + (0.0341 - 0.02342T + 0.00316T^2)N^2$$

$$e_4 = 0.5(1+T) - (1.14 - 0.52T)C.$$

(e_2 and e_4 apply only when lime is present.)

In these equations E is the expansion (microns per cm) at any temperature, B and C are the percentages of soda and lime, respectively, T is temperature divided by 100, and T_c is the "critical temperature" or the temperature at which rapid expansion begins. The critical temperature can be computed from:

$$T_c = 526 - 1.7B + 3C.$$

Publications.—On a Modified Method for Decomposing Aluminous Silicates for Chemical Analysis, by A. N. Finn and J. F. Klekota, B. S. Jour. Research, vol. 4, No. 6, p. 809; June, 1930.

The Government in Ceramics, Ceramic Age, p. 132; March, 1931.

On the Direct Determination of Soda in Soda-Lime Glasses by Precipitation as Uranyl Zinc Sodium Acetates, by F. W. Glaze, J. Am. Ceram. Soc., vol. 14, No. 6, p. 450; June, 1931.

The Index of Refraction of Some Soda-Lime-Silica Glasses as a Function of the Composition, by C. A. Faick and A. N. Finn, B. S. Jour. Research, vol. 6, No. 6, p. 993; June, 1931. J. Am. Ceram. Soc., vol. 14, No. 7, p. 518; July, 1931.

Effects of Variations in Composition on Vitreous Enamels.—Previous work showed that two enamels of identical calculated composition, but compounded from different raw materials, may have somewhat different fusibilities when prepared in the usual way. Further investigation indicated that: (*a*) When the two enamels were smelted in platinum, no significant difference in fusibility was apparent; (*b*) both types appeared somewhat less fusible when smelted in rotating, refractory-lined crucibles; and (*c*) when a large difference in fusibility between the two types was found, corresponding variations were found in the chemical composition of the enamels.

Four different tests for fusibility have been employed in studying 11 ground-coat enamels, varying in boric oxide-sodium oxide ratio and in flint-feldspar ratio over the practical limits of composition. The same general relationship of fusibility to composition exists in the data from all four tests, namely: (*a*) Cone deformation tests; (*b*) "fusion block" flow tests; (*c*) slumping temperature tests (by the interferometer method); and (*d*) "button" tests (observing the dimensions of the resulting "buttons" when cylinders of enamel powder are heated under standard conditions). The following is a

set of data on cone-deformation temperatures which is also typical of the results of the other tests on fusibility:

Enamel	Key to composition [1]				Cone-deformation temperatures	
	Feldspar	Flint	Sodium oxide	Boric oxide		
	Per cent	*Per cent*	*Per cent*	*Per cent*	*°C.*	*°F.*
a	35	25	17	13	645	1,193
b	35	25	14	16	670	1,238
c	35	25	11	19	690	1,274
d	30	30	17	13	648	1,198
e	30	30	14	16	676	1,249
f	30	30	11	19	698	1,289
g	25	35	17	13	659	1,218
h	25	35	14	16	688	1,270
i	25	35	11	19	707	1,304

[1] Constant portion of batches not given.

Variations in the sodium oxide-boric oxide ratio affected the fusibility more readily than variations in the flint-feldspar ratio. Thus the change from (*a*) to (*b*) caused nearly twice the elevation in cone-deformation temperature as the change from (*a*) to (*g*), although the variation in ratio of the constituents involved was greater in the second case.

Apparatus has been assembled and tests begun on thermal expansivity, modulus of elasticity, and tensile strength, for which over 10,000 specimens have been prepared.

Publications.—Blistering Tendency of Some Cast Irons When Enameled, by A. I. Krynitsky and W. N. Harrison, Trans. and Bull., Am. Foundrymen's Assn., vol. 1, No. 8, p. 332; August, 1930.

The "Microchilled" Surface of Some Cast Iron and Its Relation to Blistering in Enameling, by A. I. Krynitsky and W. N. Harrison, Metals and Alloys, vol. 1, No. 14, p. 663; August, 1930.

Blistering of Enamel on Cast Iron, Ceramic Industry, vol. 15, No. 2, p. 181; August, 1930.

HEAT AND TEMPERATURE MEASUREMENTS

Intercomparison of Temperature Scales of National Laboratories.—Under an exchange arrangement with the Physikalisch Technische Reichsanstalt Prof. Dr. F. Henning, chief of the division of heat and pressure of that institution spent about six weeks at the bureau in April and May of 1931, taking an active part in the work of the heat and power division. Comparisons of the temperature scales of the two laboratories were made. These were part of a general program now under way for comparing the temperature scales of the national laboratories of England, Germany, and the United States and that of the University of Leiden, the last in the range of low temperatures. Comparisons of resistance thermometers were made in the range from −183° to +630° C., and the Reichsanstalt scale was found to be in agreement with that of the bureau within a few thousandths of a degree at the points where the more precise measurements could be made and within a few hundredths of a degree at the extremes of the range.

The work of the interlaboratory comparison of the thermo-electric portion of the scale, range 660° to 1,063°, was completed. The laboratories are in good agreement on this portion of the scale, except at the freezing point of silver, where there are differences of a few tenths of a degree. The comparisons of the optical part of the scale, above 1,063° C., are not completed, but the results so far obtained indicate satisfactory agreement.

Waidner-Burgess Standard of Light.—A proposal was submitted to the Advisory Committee on Electricity of the International Committee on Weights and Measures that the reproducible light standard, developed last year at the Bureau of Standards, be adopted as an international standard. Final action, however, was not taken at the 1931 meeting, as the other national laboratories had not yet had time to give the proposal sufficient study.

Publications.—The Waidner-Burgess Standard of Light, by H. T. Wensel, W. F. Roeser, L. E. Barbrow, and F. R. Caldwell, B. S. Jour. Research, vol. 6, No. 6, p. 1103; June, 1931.

The Freezing Point of Platinum, by W. F. Roeser, F. R. Caldwell, and H. T. Wensel, B. S. Jour. Research, vol. 6, No. 6, p. 1119; June, 1931.

Special Refractories for Use at High Temperature, by W. H. Swanger and F. R. Caldwell, B. S. Jour. Research, vol. 6, No. 6, p. 1131; June, 1931.

Freezing Point of Iridium and Its Use for Light Standard.—The freezing point of pure iridium has been determined by the crucible method in an electric induction furnace, resulting in a figure of 2,452° C., ±3°.

Preliminary observations of the brightness of a black body at the freezing point of iridium, following the same technique as that for the Waidner-Burgess light standard, using platinum, have shown that the iridium freezing point can be so used, but with much more difficulty than with platinum. It can be used conveniently, however, for stepping up from carbon filament to tungsten filament lamps. The preliminary figure obtained for brightness of this standard is 1,250 candles per cm^2 in terms of the bureau's derived tungsten standards.

Liquefaction of Helium.—Helium was liquified on April 3, 1931, for the first time in the United States, and with it a temperature of −271.3° C. (−456° F.) was attained, which is only 1.9° C. or 3.4° F. above the absolute zero of temperature.

Publication.—Liquid Helium, by H. C. Dickinson, Scientific Monthly, vol. 34, p. 75, January, 1932.

Vapor Pressure of Carbon Dioxide.—Previous measurements at temperatures down to −50° C. had been made at this bureau. The range of observations has been extended to −78° C. Observations below this temperature are not considered necessary since sufficiently accurate measurements have been made at other laboratories. All available data are being correlated.

Specific Heats at Low Temperatures.—In cooperation with the fixed nitrogen research laboratory of the Department of Agriculture, a project was undertaken for the determination of the specific heats of nitrogen organic compounds down to solid hydrogen temperatures, and for the calculation of the entropies and free energies of the compounds from their specific heats.

The construction of the apparatus was completed and the determination of the specific heat of primary amyl ammonium chloride is under way.

Heats of Combustion of Hydrogen, Methane, and Carbon Monoxide.—Final "best" values for the heats of combustion of these gases have been published. The heat evolved when hydrogen, methane, and carbon monoxide are burned with oxygen, at 25° C. and a constant pressure of 1 atmosphere, to form liquid water and/or gaseous carbon dioxide was found to be as follows:

Hydrogen	285,775± 40 international joules per mole
Methane	890,160±300 international joules per mole
Carbon monoxide	282,890±120 international joules per mole

Publications.—The Heat of Formation of Water, and The Heats of Combustion of Methane and Carbon Monoxide, by Frederick D. Rossini, B. S. Jour. Research, vol. 6, No. 1, p. 37; January, 1931, and vol. 7, No. 2, p. 329; August, 1931; Proc. Nat. Acad. Sci., vol. 16, No. 11, p. 694; 1930.

Heat Content of Phosphorus Pentoxide.—Determinations of the heat content of phosphorus pentoxide between room temperature and various temperatures up to 1,000° C. are under investigation. A preliminary value of the difference in heat content between crystalline phosphorus pentoxide at 20° C. and phosphorus pentoxide vapor at 700° C. is 222 calories per gram.

Heats of Combustion of Methyl and Ethyl Alcohols.—Per gram mole of the liquid alcohol at 25° C. and constant pressure of 1 atmosphere, the heats of combustion are:

Methyl alcohol (liquid)—726.25±0.20 international kilojoules.
Ethyl alcohol (liquid)—1366.31±0.40 international kilojoules.

Publication.—The Heat of Combustion of Methyl Alcohol, by Frederick D. Rossini, Proc., Nat. Acad. Sci., vol. 17, No. 6, p. 343; 1931.

Coefficient of Thermal Expansion of Solid Benzoic Acid.—The value of this coefficient between 15° and 30° C. has been determined by the aid of a constant volume, gas-filled dilatometer and found to be 0.00052 per degree centigrade.

The Heat Content of Aqueous Solutions of Certain Electrolytes.—A critical review and recalculation of the existing data on the heat capacities of aqueous solutions of 19 uni-univalent electrolytes was made. Values were obtained for computing all the heat capacity properties for aqueous solutions of the chlorides, bromides, iodides, nitrates, and hydroxides of hydrogen, lithium, sodium, and potassium from 0 to 2.5 molal, at 18 to 25° C.

Publications.—Heat Content Values for Aqueous Solutions of the Chlorides, Nitrates, and Hydroxides of Hydrogen, Lithium, Sodium, and Potassium at 18° C., by Frederick D. Rossini, B. S. Jour. Research, vol. 6, No. 5, p. 791; May, 1931.

Apparent and Partial Molal Heat Capacities in Aqueous Solutions of 19 Uni-Univalent Electrolytes, by Frederick D. Rossini, B. S. Jour. Research, vol. 7, No. 1, p. 47; July, 1931.

Heat of Ionization of Water.—This has recently been recalculated and the best value on the basis of existing data is 57,370 absolute joules per mole at 18° C.

Publication.—The Heat of Ionization of Water, by Frederick D. Rossini, B. S. Jour. Research, vol. 6, No. 5, p. 847; May, 1931.

Cryoscopic Constant, Heat of Fusion, and Heat Capacity of Camphor.—These constants were determined during the year in order to clear up

contradictory values reported in the literature. The new values are: Heat of fusion at 178.4° C., $L_F = 1{,}630 \pm 60$, $cal._{15}$ $mole^{-1}$; the cryoscopic constant, $k_F = 37.7 \pm 1.4$ deg. C. $mole^{-1}$ kg.; the heat capacity of crystalline camphor in the range from 20° to 178.4° C., $C_{solid} = 64.0 + 0.033t \pm 0.5$ $cal._{15}$ $mole^{-1}$ deg. $C.^{-1}$; the heat capacity of liquid camphor in the range from 178.4° to 210° C., $C_{liquid} = 87 \pm 7$, $cal._{15}$ $mole^{-1}$ deg. $C.^{-1}$.

Publication.—Cryoscopic Constant, Heat of Fusion, and Heat Capacity of Camphor, by M. Frandsen, B. S. Jour. Research, vol. 7, No. 3, p. 477; September, 1931.

Properties of Organic Liquids.—Using the methods and apparatus previously developed for measurements of thermal properties of water and steam, values were obtained for the heat content and latent heat of vaporization of methyl alcohol, ethyl alcohol, and benzene, in the range 40° to 110° C.

Publication.—Calorimetric Determinations of Thermal Properties of Methyl Alcohol, Ethyl Alcohol, and Benzene, by E. F. Fiock, D. C. Ginnings, and W. B. Holton, B. S. Jour. Research, vol. 6, No. 5, p. 881; May, 1931.

Properties of Steam.—Measurements of latent heat of vaporization of water have been made at temperatures of 50°, 70°, and 90° C. These extend the range previously completed, and in this range confirm the latent heat formula previously derived.

Apparatus is now nearing completion for extending measurements of the heat content of saturated water and steam up to pressures of 2,500 lbs./in.^{2} or higher.

At the second international steam table conference held in Berlin, June, 1930, the values of heat content of water and steam measured at this bureau up to 800 pounds pressure were adopted as definite values in the skeleton or master table.

Publications.—Report of Progress in Steam Research at the Bureau of Standards, by N. S. Osborne, Mechanical Engrg., vol. 53, No. 2, p. 137; February, 1931.

A Calorimetric Determination of Thermal Properties of Saturated Water and Steam from 0° to 270° C., by N. S. Osborne, H. F. Stimson, and E. F. Fiock, B. S. Jour. Research, vol. 5, No. 2, p. 411; August, 1930.

A Review of Calorimetric Measurements on Thermal Properties of Saturated Water and Steam, by E. F. Fiock, B. S. Jour. Research, vol. 5, No. 2, p. 481; August, 1930.

Thermal Conductivity of Insulating Materials at High Temperatures.—Apparatus of the flat plate type was designed and constructed for use up to 1,000° C. Experiments have been made to test the accuracy and limitations of the apparatus and it has been found that at the higher temperatures the probable accuracy is considerably diminished on account of uncertainties due to electrical leakage. This is caused by the great increase with temperature of the electrical conductivity of the ceramic materials of which the heater plates are composed.

Heat Transfer Through Metal-Inclosed Insulation.—In certain types of thermally insulated structures, such as insulated sheet metal doors, it is desirable to inclose the insulating material completely. In designing such a structure, a knowledge of the decrease in insulating value caused by conduction of heat in the metal around the edges is important. Mathematical analysis of the problem and calculation of a number of special cases have been made, in order to bring

out the limitations and possibilities of this general type of insulated structure. The general conclusion may be stated that unless very thin sheet metal of low thermal conductivity is used at the edges, a considerable proportion of the total heat flow is conducted in the metal around the edges.

Publications.—Heat Transfer Through Metal-Inclosed Insulation, by M. S. Van Dusen, B. S. Jour. Research, vol. 5, No. 2, p. 385; August, 1930.

Revision of Federal Specification for Industrial Thermometers.—Federal Specifications Board specification 472A for industrial thermometers was revised according to suggestions from the committee on thermometers and in cooperation with the Navy Department.

Boiling Liquid Cryostat.—A new boiling liquid cryostat in which liquid air or liquid hydrogen are made to boil at reduced pressures was developed for maintaining temperatures constant from –183° down to –259° C. With it a determination of the triple point pressure of hydrogen was made, and it was used to calibrate low temperature thermometers from –190° to –210° C and from –252° to –259° C.

Publications.—A Precision Cryostat with Automatic Temperature Regulation, by R. B. Scott and F. G. Brickwedde, B. S. Jour. Research, vol. 6, No. 3, p. 401; March, 1931.

An Automatic Constant Level Device for Liquid Air, by R. B. Scott and F. G. Brickwedde, The Review of Scientific Instruments, vol. 2, No. 3, p. 171; March, 1931.

Silvering and Evacuation of Dewar Flasks.—An investigation of the methods of silvering and evacuating Dewar flasks was carried out, and as a result a laboratory technique was developed whereby flasks can be prepared which have exceptionally good insulating properties.

Publication.—Silvering and Evacuation of Pyrex Dewar Flasks, by R. B. Scott, J. W. Cook, and F. G. Brickwedde, B. S. Jour. Research, vol. 7, No. 5, p. 935; November. 1931.

HYDRAULICS

The National Hydraulic Laboratory.—The design of the hydraulic laboratory was begun about July 1, 1930. With the aid of an advisory committee consistsing of a number of prominent hydraulic engineers, several designs were prepared and discussed. The final design was adopted early in January, 1931, and the construction of the building was started on April 23, 1931. It is expected that the building will be completed in March, 1932.

The design provides for a building about 285 feet long, 60 feet wide over part of its length and 92 feet wide over the remainder. There will be three stories at one end and two stories at the other. The building will contain two large concrete supply basins from which water will be pumped through the flumes and other experimental apparatus to a concrete measuring basin from which it will be returned through channels to the supply basins. A maximum flow of 250 to 300 cubic feet per second will be possible in the main flume. This flume is the dominating piece of equipment in the building and has a cross section 12 feet wide by 12 feet high over a length of approximately 200 feet. As much free floor space as

possible will be provided for models of hydraulic structures and testing equipment.

Publication.—The National Hydraulic Laboratory at the Bureau of Standards, by George K. Burgess, Civil Engineering, 1, No. 10, p. 911; July, 1931.

IDENTIFICATION OF GUNS, BULLETS, AND DOCUMENTS

Assistance to the Federal Government.—This work has shown a notable increase during the year. However, ballistic identification equipment has been designed and tested for the police department of the District of Columbia which will relieve the bureau of much of this type of testing.

In the identification of handwriting and typewriting for the Federal Government, three cases have been prosecuted and convictions secured in each. One of these resulted in a saving to the Government of over $150,000. Some tests have been for the information of administrative officers dealing with personnel matters. Others have related to criminal violations, and where identifications have been positive prosecutions have been instituted. Several cases have been dropped because of lack of agreement in the evidence submitted.

Lectures have been given before each of the classes of students training for service in the Department of Justice. In these, the proper procedure and results to be expected in this type of investigation were explained.

LEATHER

Acid in Leather.—Research designed to establish limits for the amount of sulphuric acid which may be present in leathers for different uses was continued, using leather tanned with quebracho-wood and chestnut-wood extracts. Work was completed on four projects which showed that leather tanned with quebracho-wood extract possessed a greater resistance to deterioration by sulphuric acid than leather tanned with chestnut-wood extract, that the hydrolysis of the leather by sulphuric acid as measured by the soluble nitrogen extractable increased with time and acid concentration, that the addition of grease to leather after adding sulphuric acid did not retard the deterioration of the leather, and that deterioration proceeded at a greater rate at high relative humidities. Reports on all of this work will be published during the coming year. The work has a distinct bearing on the establishing of quality standards for leather since the limitation of the mineral acidity is considered most essential.

Specifications and Properties of Leather.—Preliminary work was started during the year on the properties of several leathers which are purchased by the Government departments. A study of the water absorption properties of hydraulic packing leathers and the physical and chemical properties of alum, Indian, and chrome tanned lace leathers was made to secure information for use in connection with the revision of existing Government specifications. A study was also made of the chemical properties and physical properties of mineral-tanned hydraulic leathers particularly with reference to their resistance to heat for use in developing a new Government

specification. The Government specification for vegetable-tanned leather belting was selected as a basis for drafting a national standard for this commodity under the American Standards Association. The chairmanship of the subcommittee to draft the specification is held by a member of the bureau's staff and considerable preliminary work has been done in assembling comments and existing information for use in the project.

Properties of Fur-Seal Skins.—The value of a fur skin is largely governed by the appearance of the fur and by the type of animal from which the skin is taken. It appears equally important in judging durability to consider the type of tannage used for preserving the skin and the properties of the leather backing which holds the fur. Accordingly a study has been made of the physical properties of commercial fur skins from Alaskan seals in which the Government has a vital interest. Values were established for such properties as strength, stretch, thickness, and tearing resistance, and data were secured showing the influence of certain manufacturing operations on these properties. This is the first generally available information relative to the physical properties of fur-seal skins and is of value in establishing standards for regularly checking the annual production of the fur skins.

Publication.—Some Physical Properties of Fur-Seal Skins, by R. C. Bowker, J. Tech. Assoc. Fur. Ind., vol. 11, No. 2, p. 34; June, 1931.

Salt Used for Curing Hides and Skins.—Stains and blemishes on hides and skins are a source of loss and annoyance to producers of leather. The formation of these stains has been attributed, in part, to impurities existing in the salt used for curing processes. Twenty-nine representative samples of mined and evaporated salts produced in different geographical locations within the United States were selected for examination. The composition of these samples was determined with respect to moisture, insolubles, iron, calcium, magnesium, sulphates, carbonates, phosphates, silica, aluminum, arsenic, boron, and sodium chloride. The results show that, for the use intended, most of the salts possess a high degree of purity. The information has been presented as a reference for those interested in research problems having to do with the influence of salt used in curing upon the formation of stains and blemishes as well as for a basis in establishing standard specifications covering the quality of salt for curing purposes.

Publication.—Analysis of Salt Used for Curing Hides and Skins, by R. C. Bowker and John Beek, jr., J. Am. Leather Chem. Assn., vol. 26, No. 6, p. 312; June, 1931.

LENS DESIGN

Optical Instruments.—In connection with the designing of optical systems, new formulas and standardized methods are being developed. Recent work which has been completed includes the derivation of algebraic formulas for the geometric aberrations of the fifth, seventh, ninth, and eleventh orders, and direct algebraic methods by which the phase differences at the image point corresponding to the geometric aberrations may be determined.

LIME AND GYPSUM

Particle Size Distribution of Hydrated Lime.—Since particle size has undoubtedly a direct bearing upon certain other properties of hydrated lime, an automatic weighing device has been assembled for the determination of the rate of sedimentation of fine particles in suitable liquid media. To calibrate the sedimentation apparatus, glass spherules have been separated into fractions wherein most of the material is within 2 microns of the average diameter. With this fractionated material check sedimentation curves have been obtained with the automatic recording balance. The particle size as determined in this manner agrees very closely with that ascertained microscopically.

Heat of Solution of Calcium Sulphate and Its Hydrates.—Methods have been devised for the preparation of very pure gypsum and hemihydrate. A solution of ammonium acetate has been found to be a satisfactory solvent for calcium sulphate. Twin calorimeters are being assembled for measuring the heats of solution aiming at an accuracy of 3 to 5 parts in 10,000.

Specifications.—Federal specifications on the following gypsum products have been revised:

Gypsum, calcined	SS–G–901
Plaster, gypsum	SS–P–401
Plaster-board, gypsum	SS–P–431
Wall-board, gypsum	SS–W–51

A Modified Test for Soundness of Finishing Limes.—A method has been developed whereby a finishing lime may be tested within four hours to determine whether or not in actual use in a plastered wall, it will show evidence of a defect known as pitting or popping. By steaming a sample of finishing lime for two hours in an autoclave at 120 pounds per square inch pops will appear in that pat, which may take months or years to appear in the plastered wall. The method can be carried out in a much shorter time than the one now in use, which requires four days for completion, and is also in far better agreement with the actual performance of the lime in a wall as was determined by test panels.

Publication.—A Modified Test for Soundness of Finishing Limes, by D. L. Bishop, Rock Products, vol. 34, p. 67, July 18, 1931.

Specifications.—Federal specifications on the following lime products have been revised:

Lime; hydrated (for) structural purposes	SS–L–351
Quicklime (for) structural purposes	SS–Q–351

Hydraulic Lime.—It has been found that an hydraulic lime may be produced by calcining a chalk containing diatomaceous silica. Briquets containing 1 part of the hydraulic lime to 3 parts of standard testing sand had tensile strengths as high as 290 and 400 lbs./in.^{2} at the end of one and three months, respectively.

Volumetric Changes of Gypsum Fiber Concrete.—Because of the lack of design information and data on which building code requirements might be based, Committee C–11 (on gypsum) of the American Society for Testing Materials appointed a subcommittee to cooperate with the bureau to obtain the desired data. Having obtained data on the strength of gypsum fiber concrete, an investigation was started of the volumetric changes of this material, including setting and

thermal expansions. It was also found that the expansions of neat gypsum at the end of the fourteenth cycle of alternate drying and wetting ranged from 0.03 to 0.12 per cent over the original dry length, and from 0.15 to 0.31 per cent for those specimens containing 12.5 per cent wood chips. Specimens of the same material showed much smaller changes when exposed alternately to air of low and high relative humidity.

Freezing and Thawing Tests on Sand-Lime Brick.—In order to determine the importance of absorption requirements in specifications for sand-lime brick as a measure of weather resistance, 22 sets of 10 half-brick each, having various absorption properties previously determined, were subjected to 50 alternate cycles of freezing and thawing. No apparent relation was found to exist between the amount of absorption and the resistance to freezing and thawing. It was found, however, that a brick having both a fast rate of absorption in partial immersion and a high strength was likely to withstand freezing and thawing satisfactorily. It was also found that both modulus of rupture and compressive strength are more indicative of resistance to freezing and thawing than total absorption.

Publication.—Results of Freezing and Thawing Tests on Sand-Lime Brick, by H. F. McMurdie, Rock Products, June 6, 1931.

LUBRICATION AND LIQUID FUELS

Hydrocarbons from Petroleum.—In cooperation with the American Petroleum Institute the investigation dealing with the determination of the composition of petroleum has been continued, and the following hydrocarbons have been isolated and the quantities present in the petroleum have been determined: Ethane; propane; butane; cyclopentane; *n*-hexane; 2, 3-dimethylbutane; 2-dimethylpentane; 3-methylpentane; toluene; methylcyclohexane; *n*-heptane; 2, 2-dimethylpentane; xylenes (3); *n*-octane; *n*-nonane.

Publications.—The Problem of Establishing the Identity and Purity of a Hydrocarbon Obtained from Petroleum, by E. W. Washburn, Ind. Eng. Chem., vol. 22, p. 985; 1930.

On the Determination of the Empirical Formula of a Hydrocarbon, by E. W. Washburn, B. S. Jour. Research, vol. 5, No. 4, p. 867; October, 1930.

The Isolation of the Isomers of Hexane from Petroleum, by J. H. Bruun and M. M. Hicks-Bruun, B. S. Jour. Research, vol. 5, No. 4, p. 933; October, 1930.

Determination of the Toluene Content of a Midcontinent Petroleum, by J. H. Bruun, R. T. Leslie and S. T. Schicktanz, B. S. Jour. Research, vol. 6, No. 3, p. 363; March, 1931.

Separation of *n*-octane from Petroleum by Distillation and Crystallization, by R. T. Leslie and S. T. Schicktanz, B. S. Jour. Research, vol. 6, No. 3, p. 377; March, 1931.

Determination of the Benzene and the Normal Hexane Content of a Midcontinent Petroleum, by J. H. Bruun and M. M. Hicks-Bruun, B. S. Jour. Research, vol. 6, No. 5, p. 869; May, 1931.

Compressibility and Thermal Expansion of Petroleum Oils.—This investigation was carried on in cooperation with the American Petroleum Institute. A paper giving the results of the investigation was published in the Bureau of Standards Journal of Research.

Publication.—Compressibility and Thermal Expansion of Petroleum Oils in the Range 0° to 300° C., by R. S. Jessup, B. S. Jour. Research, vol. 5, No. 5, p. 985; November, 1930.

Pressure-Volume-Temperature Relation of Oil-Gas Mixtures.—In cooperation with the American Petroleum Institute, measurements have been made of the volume and density of the liquid phases and the density of the gas phases of three crude oil-gas mixtures at various pressures and temperatures. The pressure range covered was 1 to 200 atmospheres, and the temperature range 30° to 90° C.

Thermal Properties of Oils.—This investigation has been conducted in cooperation with the American Petroleum Institute. Values have been obtained for the specific heats of (1) gasolines from 30° to 120° C.; (2) gas oils from 30° to 180° C., and (3) lubricating oils from 30° to 200° C. which substantiate equation (5), page 26, B. S. Miscellaneous Publication No. 97, and the equation for specific heat on page 151, International Critical Tables, vol. 2.

Gumming Characteristics of Gasoline.—An extensive investigation is being made to develop significant test methods for determining the gum content of gasolines and its tendency to increase during storage under various conditions. Much suggestive information has been obtained to date in this study.

Publication.—A Comparison of Methods for Determining Gum Contents of Gasolines, by O. C. Bridgeman and E. W. Aldrich, Soc. Automotive Engrs. J., vol. 28, p. 191; February, 1931.

Oiliness of Lubricating Oils.—The frictional characteristics of a series of representative lubricating oils have been determined on the grooved specimen, Herschel, Kingsbury, and Timken oiliness machines. The results indicate that quantitative values obtained on each machine depend to a great extent upon the particular design and mode of operation. They indicate also that a more certain control of factors involved in oiliness tests is needed. This work was done in cooperation with the American Society of Mechanical Engineers.

Publications.—Surface Tension of Soap Solutions and Its Relation to the Thickness of Adsorbed Films, by R. Bulkley and F. G. Bitner, B. S. Jour. Research, vol. 5, No. 4, p. 951; October, 1930.

Viscous Flow and Surface Films, by R. Bulkley, B. S. Jour. Research, vol. 6, No. 1, p. 89; January, 1931.

Journal-Bearing Performance.—In cooperation with the American Society of Mechanical Engineers, the distribution of hydrostatic pressure in the oil film of a journal bearing has been determined. Nine tests were made covering a fairly wide range of typical conditions of operation.

Efficiency of Gears.—In cooperation with the American Electric Railway Engineering Association, the friction losses under various conditions of operation have been determined for three types of street-car reduction gearing. These include a single reduction, double reduction, and worm gear.

Publication.—Progress Report on Efficiency Tests of Electric Street Car Trucks. Proc. Am. Elect. Ry. Eng. Assoc. (Appendix A of Report of Research Subcomm. No. 3, Car Design); 1930.

MECHANICAL APPLIANCES AND ENGINEERING INSTRUMENTS

Methods of Locking Screw Threads.—This investigation was undertaken for the purpose of determining the locking properties of the

various commercial devices for preventing the nut from unscrewing on the bolt and to secure fundamental data on the subject for engineers.

All known manufacturers of thread-locking devices were invited to participate in the investigation, the first part of which was to determine statically the torque-tension characteristics of all devices. These torque-tension tests have been completed. A total of 41 devices were tested, including nonproprietary devices, such as standard nuts, jam nuts, and slotted nuts with cotter pins.

Only about 22 per cent of the devices showed appreciable difference in static torque-tension characteristics from that of the coarse-thread standard nut. In only one device was the screwing-off torque greater than the screwing-on torque at all stresses.

Postage-Metering and Stamp-Vending Devices.—The investigation and testing of mail metering and similar automatic postal devices, undertaken at the request of the Post Office Department to determine their suitability from the standpoint of mechanical design, with particular reference to assuring their accuracy and reliability for Government use, have been continued. There has been a rapid expansion in the development of machines of this nature, and the volume of this work has shown a marked increase in the past year.

Heating Appliances for Government Buildings.—An extended series of performance tests of radiator room-temperature-control valves, with special reference to the particular conditions of service obtaining in the new building of the Department of Commerce, was made for the Office of the Supervising Architect of the Treasury Department. Tests of several types of radiator return-line traps, for compliance with performance standards previously established, were also made for the same office.

Investigation of Propeller Fans.—A study was made of the effect of certain entrance conditions on the performance of 2-blade propeller fans and of the effect of increasing the number of blades from 2 to 4.

Publication.—Further Measurements of Propeller Fan Characteristics, by Paul S. Ballif and H. L. Dryden, B. S. Jour. Research, vol. 6, No. 3, p. 387; March, 1931.

Elevator Safety Interlocking Devices.—The tests of elevator interlocking devices, to determine their compliance with the performance requirements for effectiveness and reliability, which have now been adopted as "American standards," have been extended to include additional devices. The results of these tests are used as the basis of approval, in their respective jurisdictions, by Government departments, certain State governments, and a group of casualty insurance companies.

Fire-Extinguishing Appliances and Equipment.—For several years the bureau, at the request of the Steamboat Inspection Service, has investigated and tested fire-extinguishing appliances and systems for use on vessels. The technical data on their effectiveness and reliability thus secured have served as a basis for their approval. There has been great activity in this field recently and the volume of such work showed a marked increase during the past year.

METALS

Fundamental Constants and Properties of Pure Metals.—A report has been published giving the fundamental physical properties of nickel of the highest attainable purity, 99.94 per cent with not over 0.001 per cent oxygen. Data were obtained on density, crystal-lattice parameter, melting point, electrical resistivity, magnetic properties, thermal e. m. f., thermal expansion, hardness, tensile strength, and reflectivity.

As part of the bureau's cooperative program with the alloys-of-iron committee, Engineering Foundation, a critical review of the literature on pure iron has been made and a monograph is in preparation. Laboratory work on the preparation of pure iron by precipitation and reduction methods is well under way. The determination of the fundamental properties of this metal which forms the basis of all steels is considered of great importance.

A very thorough survey of the technical literature of zinc and zinc-base alloys has been completed, and a circular on the subject, Zinc and Its Alloys, has been issued.

Publication.—The Properties of Pure Nickel, by L. Jordan and W. H. Swanger, B. S. Jour. Research, vol. 5, No. 6, p. 1291; December, 1930.
Zinc and Its Alloys, B. S. Circular No. 395.

Thermal Conductivity of Metals.—By means of a recently developed comparison method for determining thermal conductivity at elevated temperatures, this property has been determined over the temperature range 50° to 550° C. for a considerable number of commercial steels and alloys. The thermal conductivity of lead, 0.352 W cm^{-1} deg^{-1}, has been used as the basis of this comparison method. The thermal conductivities of graphite, pure metals, cast iron, carbon steels, and low-alloy steels were found to decrease with increase of temperature. For most steels of high alloy content, the opposite was found to be true, however. The case of nickel was of unusual interest. A decrease in thermal conductivity with increasing temperature was found for the range 50° C. to the Curie point, 360° C. approximately. Above this point, an increase of temperature was accompanied by a marked increase in thermal conductivity. The report is nearly ready for publication.

Corrosion of Metals.—As an aid in the development of corrosion-testing methods for giving reliable and reproducible results, the study of the effect of the degree of aeration upon corrosion of metals submerged in water has been continued. Results have been obtained on the rate of initial corrosion of a number of irons and low-carbon steels in water, the oxygen content of which varied from an extremely low value to saturation. The pH of the solutions was varied from 4.5 to 8.0. In waters of low oxygen content, the rate of initial corrosion was found to increase with increase in oxygen content. With high oxygen content, however, a reversal occurred and the rate of initial corrosion decreased with increasing oxygen content. The oxygen content corresponding to the maximum rate of corrosion was found to vary with the pH of the water.

Cooperation with the American Society for Testing Materials in the exposure tests of galvanized products, nonferrous sheet metals, and screen wire cloth has been continued. The initial weighing of

the nonferrous sheet materials has been completed and the samples exposed in nine locations representative of widely different climatic conditions in the United States.

Publication.—Oxygen as a Factor in Submerged Corrosion, by E. C. Groesbeck and L. J. Waldron, Am. Soc. Test. Mtls. Preprint No. 45; June, 1931, meeting.

Testing of Foundry Sands.—A simplified method for correlating and reporting the results of sieve tests of sands so as to take account of grain distribution has been developed. The method in ordinary use for reporting fineness of sands does not take this into account. For each sand a single numerical index, indicative of the grain distribution in the sand, is obtained which, together with the ordinary fineness number, serves to define the sand. The research committee on sands of the American Foundrymen's Association is now considering the adoption of this method as "recommended practice."

Publication.—A Grain Distribution Index for Sand Grading, by C. E. Jackson, Am. Foundrymen's Asso., Preprint No. 31–26; May, 1931, Meeting.

Copper-Base Ingot Metals.—A very great variety of copper-base ingot metals are used in the foundry industry. Many of these are only slight variations from the type alloy. In cooperation with the Non-Ferrous Ingot Metal Institute a study is in progress of the properties of typical alloys, the ultimate aim of the work being the classification of such alloys on the basis of their properties with the hope of eliminating from specifications many of the apparently unnecessary variations in chemical compositions often specified, which differ only very slightly from the "type." In the endeavor to obtain test bars whose properties are most truly representative of the alloy as a whole, bars of a number of different shapes and sizes are being cast. The effect of other variables in casting practice, such as pouring temperature, is also receiving attention.

Melting and Pouring Temperatures of Gray Iron Impact Specimens.—The pouring of 380 bars in 14 foundries was supervised and pouring temperatures measured in cooperation with the American Society for Testing Materials.

Fluidity of Liquid Metals.—The need for a suitable test method for use in the foundry for determining the pouring characteristics of a metal when cast into a mold has long been recognized. No single word expresses this characteristic of the molten metal to run and fill the mold into which it is cast. The development of a relatively simple method for this has been completed. This consists in pouring the molten metal, under the same mold conditions which are to be used in the foundry, in the form of a narrow spiral casting of uniform dimensions. The length of this spiral is a measure of those characteristics of the metal which determine its casting qualities under the conditions employed. The effect of different variables in casting practice, such as pouring temperature, degree of "tempering" of the sand, etc. can be readily demonstrated by this test.

Publication.—Fluidity Pattern Assembly, Dimensional Drawings, by C. M. Saeger, jr., and A. I. Krynitsky, Am. Foundrymen's Assoc., Preprint; May, 1931, meeting.

Shrinkage of Metals During Casting.—Methods have been developed for determining the shrinkage of a metal, as in casting, as it cools

from the liquid state down to room temperature. The complete curve shows: (*a*) The change occurring within the liquid metal as it cools, (*b*) the volume changes during freezing, and (*c*) the shrinkage and other volume changes of the solidified metal on cooling. That portion of the curve summarizing the behavior of the liquid metal is based upon specific-volume determinations of samples taken at a series of temperatures by means of a sampling device of known volume which is immersed in the liquid metal.

One progress report has been published and the complete report is nearly ready. In cooperation with the American Foundrymen's Association, the method has been applied extensively to cast irons of different compositions.

Publication.—Methods for Determining Volume Changes Undergone by Metals During Casting, by C. M. Saeger, jr., and E. J. Ash, Trans. Am. Foundrymen's Asso., vol. 38, p. 107; 1930.

Fatigue of Alclad.—"Alclad," a corrosion-resistant aluminum product, is produced by using a strong aluminum alloy as a core and facing it with very pure aluminum. As pure aluminum is practically corrosion resistant and as it is electronegative to the alloy in the core, it can be expected to afford adequate protection.

Flexural fatigue tests were made by the bureau on two groups of Alclad sheet (approximately 0.1 inch thick) having core material of (1) 17ST and (2) 17ST special aluminum alloy. The maximum fiber stress (based on the total thickness of the sheet) for which longitudinal specimens withstood 100,000,000 cycles of stress without failing, was approximately 10,500 lbs./in.^{2} for the Alclad 17ST, and 16,000 lbs./in.^{2} for the 17ST core material. For the Alclad 17ST special the maximum fiber stress was about 12,800 lbs./in.^{2} and 20,500 lbs./in.^{2} for the core material. The tests on Alclad specimens which had been subjected to 6, 12, and 18 months' exposure to salt spray gave results which corresponded approximately to the results on unexposed specimens. The tests on the core material exposed for the same time gave results corresponding to those obtained for Alclad specimens.

These results allow the aircraft designer to use Alclad light alloys with confidence for airships and airplanes.

Fatigue of Metals.—It is generally conceded that a metal which is unsound on account of inclusions has a lower endurance limit than a corresponding sounder metal. In order to determine the testing method most suitable for measuring this effect of inclusions in lowering the endurance properties of metals, an extensive comparative study has been made of two testing methods, the rotating beam and the axial loading, applied to a variety of steels and irons. The results have clearly shown that the latter is a more "searching" test. In all cases the endurance limit as determined by axial loading was lower than that obtained by the rotating beam—in some cases of rail steel, a material often highly contaminated with inclusions, the difference was as much as 25 per cent.

As part of the study of defective bridge wire, the effect of surface conditions, such as may arise in different metallurgical operations, on the endurance properties of steel has been determined. The galvanizing of steel by hot-dipping has been found consistently to lower the endurance limit of annealed and of heat-treated carbon steel.

The application of a zinc coating by electroplating, however, was found to have the opposite effect.

Bridge Wire.—A great deal of study has been devoted to heat-treated carbon steel wire which proved unsatisfactory in service for suspension bridge cables. Extensive laboratory tests of specimens prepared from the wire have failed to reveal characteristics, either in structure or mechanical properties, arousing suspicion. A unique method has been developed for testing the entire wire in fatigue. The results of such tests, as well as tests of other kinds, on the entire wire indicate that the surface characteristics undoubtedly contributed greatly to the "spontaneous" failure of this wire under load. Long-time tension tests are under way to throw further light on this point. The effect of possible changes in the wire by aging after heat treatment is being studied by thermomagnetic analysis.

Publications.—Fatigue Testing of Wire, by S. M. Shelton, Am. Soc. Test. Mtls., Preprint No. 40; June, 1931, meeting.

Thermomagnetic Investigation of Tempering of Quenched 0.75 per cent Carbon Steel, by G. A. Ellinger, B. S. Jour. Research vol. 7, No. 3, p. 441; September, 1931.

Thermomagnetic Analysis and the A_0 Transformation in 0.75 per cent Carbon Steel, by R. L. Sanford and G. A. Ellinger, Am. Soc. Test. Mtls., Preprint No. 32; June, 1931, meeting.

Rail Steel.—Further study of the quality of rail steel at high temperature has been made. Previous study had indicated a probable relationship between the low ductility, termed "secondary brittleness," observed at temperatures of 600° to 650° C., and the development of the internal defects in rail heads termed transverse fissures. By retarding the cooling rate of the rail after rolling, secondary brittleness can be minimized. Impact tests at high temperatures have demonstrated a parallelism between secondary brittleness and low impact strength in rail steel.

Machinability of Metals.—Continuing the previous work on the cutting of metals, a study was made of the effect of the composition and condition with respect to heat treatment of steel forgings on their machinability. Present studies relate to the effect of machining operations on the properties of the metal cut in the endeavor to show to what extent deleterious effects may result under certain conditions of machining.

Publications.—The Influence of Chemical Composition and Heat Treatment of Steel Forgings on Machinability with Shallow Lathe Cuts, by T. G. Digges, B. S. Jour. Research, Vol. 6, No. 6, p. 977; June, 1931; also Am. Soc. Mech. Engrs., Preprint; June, 1931, meeting.

Machinability and Tool Life, T. G. Digges, Metals and Alloys, vol. 2, p. 44; 1931.

Spark Testing of Steel.—The use of the spark test as an aid in distinguishing between Cr-Mo steel and plain carbon steel used in aircraft construction previously reported appeared so promising that a rather comprehensive study of the applicability of the spark test for steels has been made. A chart showing the spark characteristics to be looked for in establishing the identity of a steel has been prepared. Study has also been made of the characteristics of microscopic "pellets" of fused metal formed during the test to be used as an adjunct to the spark test.

Publication.—Methods for the Identification of Aircraft Tubing of Plain Carbon Steel and Chromium-Molybdenum Steel, by W. H. Mutchler and R. W. Buzzard, Nat. Advis. Com. for Aero. Tech. Note No. 350; October, 1930.

"Gas Content" of Metals.—A report describing the apparatus and analytical method developed at the bureau for the determination of "gases" in metals by the vacuum-fusion method has been prepared. During the year the method has been applied to the study of the deoxidation of steel by special methods, such as the substitution of zirconium for manganese, and in a search for the cause of the unusual behavior of certain steels, such as "abnormal" steels when carburized. As yet the method is recommended only for ferrous materials, but a number of requests for its application to nonferrous alloys have been received. A report on the carbon-oxygen solubility product in liquid steel was issued during the year. The value, 0.0025, has been found for this product and 0.011 for the carbon-ferrous oxide solubility product. Lower values reported by another research laboratory have been found to be in error.

Publications.—The Determination of Oxygen and Nitrogen in Irons and Steels by the Vacuum Fusion Method, by H. C. Vacher and L. Jordan, B. S. Jour. Research, vol. 7, No. 2, p. 375; August, 1931.

The Carbon-Oxygen Equilibrium in Liquid Iron, by H. C. Vacher and E. H. Hamilton, Am. Inst. Min. & Met. Engrs., Technical Publication No. 409, February, 1931.

Bearing Alloys.—In cooperation with a manufacturer, the relation of the wear-resistance of bearing bronzes to the temperature at which they were cast has been studied. The effect of iron as an impurity in such alloys has been determined. A report was issued on the effect of other common impurities, of which the most detrimental one appears to be antimony.

The cooperative study with the War Department on bearing alloys containing little, if any, tin has been continued. The properties at elevated temperatures of the important lead-base bearing alloys have been determined and observations are now being made of sample bearings of a number of these alloys installed in Army trucks. The leaded bronzes, containing as much as 50 per cent lead, have received a good deal of study, particular emphasis being placed on addition elements to be used for obtaining a high degree of dispersion of the lead throughout the bronze matrix.

Publication.—Bearing Bronzes with Additions of Zinc, Phosphorus, Nickel, and Antimony, by E. M. Staples, R. L. Dowdell, and C. E. Eggenschwiler, B. S. Jour. Research, vol. 5, No. 2, p. 205; August, 1930.

High-Temperature Properties of Metals.—The Cr-Fe-Ni series of alloys forms the basis of most commercial alloys intended for high-temperature service. The determination of the "creep characteristics" of representative alloys of this series has been continued. Data were published during the year on the high-temperature properties of a series of alloy steels which have served to show among other things the inability of the short-time tension test to replace satisfactorily the more expensive long-time creep test as a testing method. The effect of various alloying elements for stabilizing austenitic steel for high-temperature service has been studied in cooperation with a manufacturer. Cooperation with the joint research committee, American Society for Testing Materials, and American Society of Mechanical Engineers, has been continued with emphasis on the structural changes occurring in materials intended for high-temperature service. Embrittlement of

such alloys by carbide precipitation at high temperatures is being studied with reference to the conditions of stress obtaining in service.

Publication.—Tensile Properties of Alloy Steels at Elevated Temperatures as Determined by Short-Time Tests, by W. Kahlbaum, R. L. Dowdell, and W. A. Tucker, B. S. Jour. Research, vol. 6, No. 2, p. 199; February, 1931.

Quenching of Steel.—By means of curves showing the cooling rate at the center of a cylindrical steel specimen, one-half inch in diameter, when quenched directly from the furnace into a cooling medium, the possible usefulness of sodium silicate solutions has been studied. As intermediate solutions between oil and water, sodium silicate solutions appear much superior to glycerine and some other solutions used commercially to some extent.

Publication.—Aqueous Solutions of Ethylene Glycol, Glycerine, and Sodium Silicate as Quenching Media for Steels, by T. E. Hamill, B. S. Jour. Research, vol. 7, No. 3, p. 555; September, 1931.

Wear-Resistance of Metals.—As part of the program for the development of standard wear tests of metals, the behavior of a series of carbon steels in various conditions of heat treatment has been studied under conditions of abrasive wear by sand, and under combined sliding and rolling friction. The effect of grain size of the metal on its wearing properties, and also the influence of the atmosphere surrounding the specimens under test are being studied. Information on the behavior of chromium-plated plug gages has been obtained in a gaging machine designed for the purpose and the advantages of chromium plating on gages of simple shapes clearly demonstrated.

Publications.—The Resistance of Steel to Abrasion by Sand, by S. J. Rosenberg, B. S. Jour. Research, vol. 5, No. 3, p. 553; September, 1930.

Wear of Metals, by S. J. Rosenberg and H. K. Herschman, Metals and Alloys, vol. 2, p. 52; 1931.

The Wear of Metals, by Louis Jordan, Mech. Eng., vol. 53, p. 644; September, 1931.

Resistance to Wear of Carbon Steels, by S. J. Rosenberg, B. S. Jour. Research, vol. 7, No. 3, p. 419; September, 1931.

The Resistance of Chromium-Plated Gages to Wear, by H. K. Herschman, B. S. Jour. Research, vol. 6, No. 2, p. 295; February, 1931.

Prevention of Embrittlement of Sheet Duralumin by Atmospheric Corrosion.—As part of this study, the anodic process of oxidation for the protection of duralumin has been studied. A rapid method for determining the quality of such a coating has been developed. The usefulness of the anodic treatment as a preliminary before painting or varnishing aluminum alloys has been very satisfactorily established. The outdoor exposure tests of sheet duralumin under three widely differing climatic conditions have been continued, the fourth year of the five-year program having been completed. The results continue to support the tentative conclusions based on laboratory tests and the early exposure tests. The deleterious effect on the corrosion resistance of sheet duralumin of improper heat treatment and the relatively short life of most coatings have been well established. However, to obtain fuller tests of the materials which have so far appeared to be satisfactory, the tests will be continued for another year.

Bismuth and Its Alloys.—A method was developed for making wire by extrusion. Data on the fusible alloys of bismuth were published. This report was based upon data reported in the literature supplemented by tests at the bureau.

Publications.—Extrusion of Bismuth Wire, by J. G. Thompson, Metals and Alloys, vol. 1, p. 826; 1930.
Properties of Lead-Bismuth, Lead-Tin and Type-Metal Alloys, by J. G. Thompson, B. S. Jour. Research, vol. 5, No. 5, p. 1085; November, 1930.

METROLOGY (SCIENTIFIC)

Ruling of Line Scales by Interference Methods.—Using the equipment under construction during recent years, two meter scales and several shorter ones have been ruled, using light wave lengths to step off the intervals. One of the meter scales was subdivided into centimeters, the other into decimeters. The smaller scales were subdivided down as low as one-thousandth of an inch. These scales were ruled when the laboratory was at 20° C. Work is now under way for placing the ruling machine under accurate thermostatic control.

Precision Screws and Dividing Engine.—The precision dividing engine has been completed and the first rulings, while crude and not completely tested, give promise of a fairly satisfactory machine. Adjustment and compensation for temperature changes must be arranged. The problem is difficult (otherwise it would have been mastered years ago by the many workers in this field), and requires the utmost patience and care in locating and overcoming the many obstacles encountered.

Graduation and Calibration of Precision Circles.—Additional experience in the graduation and calibration of precision circles indicates that while the bureau's equipment is capable of graduating circles to an accuracy of two seconds or better, extreme care must be exercised in their mechanical and heat treatment, both before and after graduation, in order to maintain this accuracy. The research is being continued in order to learn more definitely the requirements as to composition, and mechanical and heat treatments to insure dimensional stability.

Effects of Wire Diameter and of Large Openings of Sieves Upon Sieving Values.—Detailed measurements of large numbers of sieves have been made in connection with work on standard samples of abrasives.

PAPER

Government Papers.—Developments in cooperative research on paper currency with the Bureau of Efficiency and Bureau of Engraving and Printing may be summarized as follows: Papers were made from highly purified wood fibers which complied satisfactorily with the currency-paper specifications and which had satisfactory printing qualities; paper-making trials of pulp from redeemed paper currency gave further evidence that satisfactory paper pulp can be made from this material; and data on optimum practice for tub-sizing currency paper were obtained.

In the cooperative research with the Bureau of Engraving and Printing on the manufacture of postage stamps the addition of

phosphoric acid to the gum was found to effect considerable improvement in the adhesion of stamps to the more resistant types of envelope papers, and an improved form of gum breaker was devised which makes the stamps more resistant to curling.

Preservation of Records.—The studies of preservation of written and printed records were continued with the support of the Brown Co., which maintains two research associates, and the Carnegie Corporation, which allotted a fund for the purpose administered by the National Research Council.

In respect to permanence classification of papers, the use of heat to accelerate chemical reactions classified the Government writing papers similarly to sunlight exposure, and in the expected order of permanence. In paper-making experiments with highly purified wood fibers in the bureau's paper mill, papers were produced which compared favorably in stability and strength with the Government permanent record and currency papers. Data were also obtained on the relation of sizing materials and fiber beating treatment to the stability of the papers. A survey of public libraries indicated that the chief external deteriorating influences are acid polution of the atmosphere, high temperature, variations in atmospheric humidity, light, and dust. Laboratory studies of effect of acid-polluted air and of light are in progress. Tests of old publications stored in libraries revealed the importance of purity of paper fibers for resistance of paper to deteriorating influences.

Publications.—Permanence Standards for Printing and Writing Papers, by B. W. Scriber, Trans. Am. Soc. Mach. Engrs., vol. 52, No. 19, PI–52–5; 1930.

The Deterioration of Paper—Studies by the United States Bureau of Standards, by B. W. Scriber, Pacific Pulp and Paper Ind., vol. 4, No. 11, p. 31; 1930.

The Determination of Alpha Cellulose and Copper Number of Paper, by J. O. Burton and R. H. Rasch, B. S. Jour. Research, vol. 6, No. 4, p. 603; April, 1931.

Light Sensitivity of Rosin Paper-Sizing Materials, by A. E. Kimberly and J. F. G. Hicks, B. S. Jour. Research, vol. 6, No. 5, p. 819; May, 1931.

Paper-Making Materials and Processes.—Experimental coating tests of domestic caseins were made to assist the Bureau of Dairy Industry in finding more suitable standards for grading caseins. Newsprint papers made in the bureau paper mill assisted correlation by the Government Printing Office, in their cooperative studies with the American Newspaper Publishers Association, of printing qualities of such papers with their components. The results of this study are reported in the Government Printing Office Technical Bulletin No. 13.

Publications.—The Preparation of Fiber Test Sheets, by M. B. Shaw, G. W. Bicking, and L. W. Snyder, B. S. Jour. Research, vol. 5, No. 1, p. 105; July, 1930.

Further Studies of Paper Coating Minerals and Adhesives, by M. B. Shaw, G. W. Bicking, and M. J. O'Leary, B. S. Jour. Research, vol. 5, No. 6, p. 1189; December, 1930.

The Paper-Making Properties of Phormium Tenax (New Zealand Flax), by M. B. Shaw, G. W. Bicking, and M. J. O'Leary, B. S. Jour. Research, vol. 6, No. 3, p. 411; March, 1931.

Standardization of Commercial Paper Products.—In cooperation with the Lithographic Technical Foundation, studies of the properties of lithographic papers relative to their printing quality were undertaken. As a survey of printing plants showed that misregister was the most important problem, the work so far has been confined

mainly to plant and laboratory studies of effect of variable humidity and tension on misregister. The properties and methods of testing paper towels, insulating boards, and binders boards were also investigated.

Paper-Testing Methods.—Cooperation with the Technical Association of the Pulp and Paper Industry in their standardization of paper-testing methods included experimental studies of measurement of grease resistance, water resistance, air resistance, and acidity. Data were obtained to assist the American Society for Testing Materials in establishment of standard procedure for determination of folding endurance of insulating papers with the M. I. T. folding tester. Further advance was made in study of hygrometry as related to paper testing.

Publication.—Critical Study of the Bursting Strength Test for Paper. by F. T. Carson and F. V. Worthington. B. S. Jour. Research, vol. 6, No. 2, p. 339; February, 1931.

PHOTOGRAPHY

Photographic Emulsions.—In the investigation of the principal independent variables of "after-ripening" (ripening after washing), the effects of temperature, bromide, and hydrogen ion concentrations were tested on emulsions made by neutral and ammonia formulas, with varying gelatin and iodide content at varying stages of ripening. Emulsions made with normal gelatin were compared with those made with deactivated gelatin and known nuclear sensitizers. The results support the chemical reaction theory of ripening.

Photographic Sensitometry.—In attempting to formulate standard methods for specifying photographic sensitivity, the variation in photographic sensitivity with the time of development has been studied, using the three most common methods of measuring sensitivity. It was found that there is an optimum development time for obtaining maximum sensitivity.

Publication.—An Experimental Study of Several Methods of Representing Photographic Sensitivity, by Raymond Davis and Gerald Kent Neeland. B. S. Jour. Research, vol. 7, No. 3, p. 495; September, 1931.

PHYSICAL CONSTANTS

Optical Properties of Crystalline Organic Compounds.—In general, crystals have three refractive indices for each light frequency. Taken together, these three indices can be used to identify the material. The optical method is indispensable to the mineralogist and is in wide use for the identification of inorganic compounds. It has been little used by organic chemists because of the inadequacy of published data. To help to relieve this situation the systematic determination of these constants is under way. The study of the formates of metals in Group II of the periodic system is nearly completed. In addition to the optical constants of the hydrated and anhydrous forms, determinations of their densities, solubilities in water, equilibrium points, and approximate decomposition temperatures are included.

Phase Equilibria in the System Zinc Oxide-Alumina-Silica.—The phase-equilibria diagram for this system has been completely worked out.

The system is characterized by two ternary eutectics at 1,305° and 1,440° C., respectively.

Phase-Equilibrium Diagram for the System Cr_2O_3–Al_2O_3.—This diagram has been determined and is characterized by complete miscibility of the two components in the crystalline state.

Publication.—Phase Equilibria in the System Cr_2O_3–Al_2O_3, by E. N. Bunting, B. S. Jour. Research, vol. 6, No. 6, p. 947; June, 1931.

Variation of Transference Number With Concentration.—A new moving boundary method has been developed by means of which it is possible to measure the change in the transference number of a given electrolyte with its concentration in aqueous solution.

Publication.—A method for Determining the Change in Transference Number of a Salt with Change in Concentration. A Modification of the Moving Boundary Method, by Edgar Reynolds Smith, B. S. Jour. Research, vol. 6, No. 6, p. 917; June, 1931.

Volume Changes at an Electrode During Electrolysis.—Due to the combined effects of the electrode reaction and the electrolytic transference, volume changes occur at each electrode during an electrolysis. The value of the total volume change is being determined by a direct method. It is needed for the proper correction of moving boundary transference measurements.

PROTECTIVE COATINGS

Soil-Corrosion Investigation.—The collection of soil-corrosion data has not progressed sufficiently to justify the setting up of standards at this time, but several methods of testing soil corrosivity and the performance of protective coatings have been developed during the year and some of them may be found suitable for adoption as standard methods after they have had more thorough trials.

The Protective Value of Electroplated Coatings.—An investigation was initiated in cooperation with the American Electroplaters' Society and the American Society for Testing Materials. Several thousand samples of steel are being plated with various metals or combinations of metals, and will be used in exposure tests in different parts of the country and in laboratory studies upon accelerated tests. The actual exposure tests will be started during the coming fiscal year.

The Porosity of Electrodeposited Chromium Coatings.—Methods for detecting porosity in chromium deposits on different metals were studied. The copper-deposition method was found to be the most reliable and most generally applicable. It was modified so as to yield semiquantitative results. This method was then used to study the porosity of chromium coatings produced under different conditions. It was found that by depositing the chromium at relatively high temperatures and current densities, the porosity can be greatly decreased.

Publication.—The Porosity of Electroplated Chromium Coatings, by W. Blum, W. P. Barrows, and A. Brenner, B. S. Jour. Research, 7, No. 4, p. 697; October, 1931.

Analysis of Silver-Plating Solutions.—Methods for the analysis of silver-plating baths have been studied in detail. Modifications or

new methods have been developed for the determination of the total cyanide, chloride, and ammonia. Present methods for the determination of silver, free cyanide, and carbonate have been confirmed.

Dimensional Changes in the Manufacture of Electrotypes.—In cooperation with the International Association of Electrotypers a study was made of the changes in dimension that may occur in each step of the electrotyping process. The resultant information will be especially useful in making electrotypes for color printing where the corresponding plates must register accurately.

Publication.—Dimensional Changes in the Manufacture of Electrotypes, by N. Bekkedahl and W. Blum, B. S. Jour. Research, vol. 6, No. 5, p. 829; May, 1931.

Durability of Varnishes.—A new test for evaluating varnishes has been developed. A varnish film is first exposed to an intense source of light for a definite period of time, after which it is bent double at a prescribed temperature over a rod of fixed diameter. The more durable the varnish the longer it may be exposed to the light before it will crack on bending. This test appears to have a number of advantages over other tests now in use for the purpose.

Publication.—A New Test for Predicting the Durability of Varnishes (The Photo-Chemical Embrittling Test), by J. H. Wilson, B. S. Jour. Research, vol. 7, No. 1, p. 73; July, 1931.

Cooperation with the American Society for Testing Materials.—The bureau cooperated with the American Society for Testing Materials in developing tentative methods of testing the tinting strength of pigments, tentative specifications for various lacquer solvents, specifications for pigments, various methods of test of paint materials, methods of analysis for cast irons and ferro-alloys and in exposure tests on the stability of samples of foundry coke.

RADIO

Primary-Frequency Standard.—Improvements have been made in the equipment of the primary-frequency standard which have resulted in increased reliability. The signals are checked against the Arlington time signals and the Riefler and Shortt clocks of the bureau, as well as against a similar standard of the Bell Telephone Laboratories in New York. The last makes use of a wire transmission of an audio frequency. The bureau's standard was found reliable in continuous service to better than 1 part in 1,000,000.

Secondary-Frequency Standards.—The performance of several temperature-controlled piezo oscillators has been studied thoroughly. They were found very satisfactory for controlling a transmitting set of exceptionally constant frequency. An improved piezo oscillator was constructed. The elasticity and vibration patterns of piezoelectric quartz have been investigated.

Publication.—Some Experimental Studies of the Vibrations of Quartz Plates, by R. B. Wright and D. M. Stuart, B. S. Jour. Research, vol. 7, No. 3, p. 519; September, 1931.

Standard-Frequency Dissemination.—The standard-frequency transmission service has been improved and extended. The regular

transmission of eight frequencies per month was continued, and this was augmented beginning January 6 by highly accurate transmissions on 5,000 kc, two hours in the afternoon and two hours at night on three days a month. These transmissions were controlled by a secondary standard piezo oscillator and maintained with an accuracy better than 1 part in 1,000,000. The bureau hopes eventually to provide one or more frequencies continuously for check and control purposes.

Improvements in Radio-Measurement Methods.—The bureau has continued its studies of transmitted radio waves. Methods for measuring these with great precision were developed. An accurate method of calibrating condensers was worked out and the necessary equipment built. An improved audio-frequency oscillator, incorporating a piezo oscillator, was also designed and built.

Publications.—A Precise and Rapid Method of Measuring Frequencies from 5 to 200 Cycles per Second, by N. P. Case, B. S. Jour. Research, vol. 5, No. 2, p. 237; August, 1930.

Accurate Method of Measuring Transmitted Wave Frequencies at 5,000 and 20,000 Kilocycles per Second, by E. L. Hall, B. S. Jour. Research, vol. 5, No. 3, p. 647; September, 1930.

Measurements of Radio Field Intensity.—Field-intensity measurements have been made between Washington and Chicago on the 5,000 kilocycle standard-frequency transmitter previously mentioned. Daytime field-intensity measurements made on broadcast and airways phone transmissions indicated that existing formulas for field intensity are not reliable for overland paths at broadcast frequencies.

Variations of Radio-Wave Intensity and Direction.—The technique of recording field intensities automatically was developed and applied to observing the synchronized transmissions of certain broadcasting stations. The fading records taken on the Byrd Antarctic Expedition have been analyzed and prepared for publication. They showed that for frequencies of about 9,000 kilocycles per second over long paths the field intensity increased with the increase of darkness over the path; as the frequency increased to about 16,000 kilocycles per second the field intensity at first increased with increase of darkness until the path was about half dark and then decreased as the darkness increased.

Measurement of the Height of the Kennelly-Heaviside Layer.—The height of the Kennelly-Heaviside layer has been regularly recorded on frequencies from 590 to 10,000 kilocycles per second. The echo method of measurement was employed. Beginning in June, 1931, Kennelly-Heaviside layer height data were furnished to Science Service for publication in the Ursigrams each week. The special transmitting and receiving apparatus developed for this work will transmit and record pulses one ten-thousandth of a second in length. Plans for an automatic continuous recorder of Kennelly-Heaviside layer heights were developed.

Publications.—Kennelly-Heaviside Layer Studies, by P. A. DeMars, T. R. Gilliland, and G. W. Kenrich, Proc. Institute of Radio Engineers, vol. 19, p. 106; January, 1931.

Kennelly-Heaviside Layer Height Observations for 4,045 and 8,650 kc, by T. R. Gilliland, B. S. Jour. Research, vol. 5, No. 5, p. 1057; November, 1930, and Proc. Institute of Radio Engineers, vol. 19, p. 113; January, 1931.

RUBBER

Properties of Rubber Insulation.—Some consideration was given to the mechanical and aging properties and the testing of rubber insulation in connection with the purchase of wires and cables by various departments of the Government. Far from affording any complete or final standardization of test methods and procedures, the work only served to indicate the need for a broad and thorough study of the field.

Rubber vulcanized with trinitrobenzene instead of sulphur was shown to be suitable for direct application on copper conductors without the necessity for tinning the conductors.

Thermal Conductivity of Rubber.—The comparative method for measuring the thermal conductivity of electrical insulating materials which was developed by the bureau in collaboration with a committee of the American Society for Testing Materials, was revised. Improved technique was developed for the preparation of samples of rubber for use as thermal conductivity standards.

Hard Rubber Photographic Trays.—A survey was made of the mechanical and chemical characteristics of hard rubber for the purpose of framing specifications for hard rubber photographic trays.

Test Samples for Rubber.—A study was made of different test samples for measuring the physical properties of rubber. The standard dumb-bell shaped sample is not entirely satisfactory for testing compounds of high rubber content because of its tendency to break outside the gage marks. A photoelastic study of the distribution of strains in this type of test piece is being made to determine how the shape of the test piece influences test results.

A study is being made of methods of preparation of rubber-test samples directly from rubber latex, thus eliminating the usual mastication processes.

A microscopic method for accurately measuring the dimensions of rubber-test pieces was developed. A paper on this subject has been prepared for publication.

Abrasion Tests for Rubber.—The performance of the new abrasion machine designed and built at the bureau has been the subject of careful study with particular attention to the determination of test conditions which simulate the wear of tire treads in service.

A publication on this subject, in addition to describing the machine, gives data showing how different types of tread compounds as well as samples taken from commercial tires perform on the machine.

Publication.—A Simple Abrasion Test Machine for Rubber, by W. L. Holt and P. A. Sigler, India Rubber World; August, 1930.

SAFETY STANDARDS

Safety Codes.—Members of the staff have participated in the work of the Safety Code Correlating Committee and in the work of various committees of national scope which have prepared safety codes. Revision of the Safety Code for Elevators, Dumbwaiters, and Escalators was completed, and text was prepared for an elevator

inspectors' handbook. Codes for mechanical refrigeration, for window washing, and for floor and wall openings were completed. A revision was undertaken of the Code for Lighting School Buildings and the Code for Automobile Brakes and Brake Testing. Work was continued on codes dealing with walkway surfaces; conveyors and conveying machinery; mechanical power transmission; and cranes, derricks, and hoists. Assistance was given State and city officials in the preparation of local regulations.

Publication.—Standard Elevator Regulations, by J. A. Dickinson, Commercial Standards Monthly, vol. 7, No. 3, p. 122; September, 1930.

Electrical Codes.—Requirements of the National Electrical Safety Code for the strength of wood poles have been modified by the adoption of new standard values for the ultimate fiber stresses of three species of wood poles. A new handbook has been prepared containing revised tables based upon the new values. A report on low-voltage electrical accidents was prepared for the National Safety Council.

Publications.—Report on Low-Voltage Electrical Hazards, by M. G. Lloyd, Transactions of American Society of Safety Engineers, Engineering Section of the National Safety Council, p. 333; 1930.

Causes of Electrical Accidents Analyzed, by M. G. Lloyd, J. Electrical Workers and Operators, vol. 30, p. 116; March, 1931.

Lightning, by M. G. Lloyd, Proceedings of the International Association of Municipal Electricians, p. 65; 1930.

X-Ray Protection.—An X-ray safety code was formulated and published as Bureau of Standards Handbook No. 15. It deals with the proper X-ray insulation of operating rooms; the proper X ray and electrical insulation of X-ray equipment; protective devices for patients and operatives; fire precaution, especially in the storage of and types of photographic films used; periodical tests; resuscitation directions for parties subjected to electric shock; and general precautions as to personnel working conditions.

Publications.—X-Ray Protection, B. S. Circular No. 374.

Röntgen Ray Protection, by L. S. Taylor, Am. J. Roent., vol. 22, p. 45; 1929.

X-Ray Protection, Report of Advisory Committee on X-Ray and Radium Protection, B. S. Handbook No. 15; 1931.

SCALES IN RAILROAD, INDUSTRIAL, AND OTHER SERVICES

Master Track-Scale Calibrations.—Eighteen of the nineteen master scales in service were visited this year and calibrated by direct application of standard test loads. Minor modifications or adjustments were made on 10 scales and all were left accurate within an "adjustment tolerance" corresponding to an allowable error limit of 0.01 per cent.

Railroad Track Scales.—Exceptionally good progress is recorded in the testing of railroad track scales, a total of 1,030 scales having been tested during the fiscal year 1931. This is the greatest number of tests which have been made in any year. Of the scales tested 75.9 per cent were correct within the bureau's tolerance which allows a mean maximum weighing error equivalent to 0.20 per cent of the applied test-load values. The average maximum weighing error was 0.21 per cent or but 0.01 per cent more than the allowable error limit. These values, in comparison with the results for the preced-

ing year, indicate a higher proportion of correct scales, but slightly greater average weighing error.

Track Scales for Weighing Grain.—Tests were made of 97 track scales utilized at grain elevators and mills for weighing carload consignments of grain in marketing transactions. Slightly more than half these scales were correct within the special tolerance of 0.10 per cent which has been established as a proper error limit. A survey extending over several years offers conclusive evidence that approximately half the track scales in grain weighing service are incapable of continuous maintenance within the tolerance recommended for them by the Interstate Commerce Commission (I. C. C. Docket 9009).

Test-Car Calibrations.—At the master scale depot, Clearing Station, Chicago, Ill., railroad track scale test weight car calibrations were made for 13 different owning systems on 28 different cars. The total number of calibrations was 57. In addition, 23 track-scale test-weight cars owned by railroads and industries which do not have access to master scales were calibrated by direct comparison with standard weight test loads in the field.

Paint Coatings for Test Weights.—A study of the durability and protection characteristics of various paints recommended for application to 50-pound test weights is under way. A large number of test weights treated with paint coatings of various kinds and placed in actual service under different usage conditions have been examined and reweighed at periodic intervals during the past year. The investigation is to continue for another year. At this time, it is indicated that constancy of test-weight values is dependent more upon conditions of handling and transportation than upon the nature of the paint coating, loss of weight being due most commonly to abrasion and chipping off of metal.

Contacts with Technical Bodies.—The bureau cooperated with the National Scale Men's Association and the American Railway Association to perfect a code of specifications for track-scale test-weight cars.

Two new projects on which the bureau will cooperate with the first-named organization are: Preparation of a code of rules for operation and maintenance of track scale test weight cars and definition of what constitutes a proper test of a railroad track scale.

Mine Scales.—The mine scale-testing equipment made tests of 140 mine scales in the coal-mining sections of West Virginia, Maryland, Indiana, and Ohio. About 48 per cent were found correct within the allowable tolerance of 8 pounds per ton of applied test load. A conspicuous increase in the proportion of correct scales is indicated. Improvement is most pronounced in the States of Maryland and West Virginia.

Improvements in Field Equipment.—A new outfit has been completed and replaces the No. 1 testing outfit which had been in use since 1913. The new equipment is strictly modern in all respects, and contains improved facilities for handling and maintenance of the weight standards.

Postal Scales and Weighing.—At the request of the Post Office Department, laboratory studies were made relative to the speed and accuracy of weighing postal matter, and numerous samples of scales

intended for postal weighings were tested. Assistance was also given the Post Office Department in the development of purchase specifications for postal scales and in the training of a field personnel which will conduct acceptance tests on new scales and routine service tests on scales in use in post offices throughout the United States.

SIMPLIFIED PRACTICE

General Conferences; Recommendations Approved by Industry; Printed Recommendations.—Twenty new simplified practice recommendations were developed by general conferences held during the year. These additions raised the total to 149, exclusive of one regional recommendation and one limitation of variety recommendation. Both of the latter, and 117 of the 149 simplified practice recommendations, have been approved and accepted by the industries affected. Twenty-five recommendations are in process of acceptance. Recommendations covering 115 commodities have been issued in printed form.

Revision and Reaffirmation Conferences.—During the period covered by this summary 37 existing recommendations were reviewed by their respective standing committees. Of these, 31, or 83.7 per cent, were reaffirmed without change, while the remaining 6 recommendations were revised. During the previous year, 34 recommendations of 39 reviewed, or 85.3 per cent, were reaffirmed.

Adherence to Simplified-Practice Recommendations.—Surveys were made of adherence in the production, distribution, and use of 13 simplified commodities. The acceptors reporting indicated that approximately 90 per cent of their volume conformed with the recommendations. Similar surveys in 1930 showed that the percentage of adherence for 25 commodities averaged approximately 87 per cent.

Degree of adherence determined by actual survey

Simplified practice recommendation No.	Item	Degree of adherence	Simplified practice recommendation No.	Item	Degree of adherence
		Per cent			*Per cent*
6	Files and rasps	96	54	Sterling silver flatware	99
8	Range boilers and expansion tanks	98	57	Wrought iron and wrought steel pipe, valves, and fittings	98
9	Woven wire fencing and fence packages	98	69	Packaging of razor blades	94
35	Steel lockers	78	81	Binders' board	51
42	Grocers' paper bags	96	84	Composition books	83
48	Shovels, spades, and scoops	95	86	Surgical gauze	98
53	Steel reinforcing bars	92		Average	90

Preliminary Conferences and Variety Surveys.—Twenty-nine preliminary conferences were held for 21 different industries. Surveys of existing diversification of product have been conducted by simplified practice committees appointed by 11 of these industries, and plans were started for similar activity by the other 10 groups.

Simplified Practice and Consumer Interest.—The 1931 Standards Yearbook contained a paragraph on the applicability of simplified prac-

tice to the problems of distribution. Particular reference was made to materials handling equipment, containers, and a survey of variety of wrapping and packing materials used by department stores.

Four recommendations in this latter field, resulting from the survey of variety, are now before industry for approval. The supplies covered are notion and millinery paper bags, corrugated boxes, folding boxes, and set-up boxes.

Recently there has developed a marked growth of consumer interest, not only as to existing recommendations but also in the establishment of new simplification programs. One project which originated during the year through the influence of consumers, and which is now before the industry for acceptance, is the packaging of overhead electric railway materials. Similarly, projects on steel office furniture and on a color code for marking steel bars are now being developed.

It is to be noted that this consumer interest is not confined to individuals. National associations representing purchasing agents, storekeepers, engineers, building and construction contractors, architects, etc., are constantly increasing their efforts in support of the simplified practice movement.

The success of simplification programs depends upon their consistent application by those concerned. To stimulate increased use of the recommendations, many manufacturers are indicating the simplified commodities in their catalogues, price lists, and advertising matter. Identifying tags and labels are, in a number of cases, attached to the articles. Consumers have found that these methods of identification eliminate the work of checking prospective purchases against the printed pamphlets.

SPECIFICATIONS

National Directory of Commodity Specifications.—The manuscript for the second edition of the National Directory of Commodity Specifications has been completed. The first edition was published in 1925 and has been widely used. It is estimated that the new volume will occupy about 500 printed pages as compared with 380 pages in the earlier edition. The increase in size is to be attributed to the more detailed description of the specifications and not to any increase in the number of specifications listed. A brief summary of each specification is given so that the reader may to some extent judge for himself whether the scope of the specification fits his needs.

Encyclopedia of Specifications.—The second volume in the Encyclopedia of Specification series, under the title "Standards and Specifications for Nonmetallic Minerals and Their Products," has been printed. The first volume of this series, "Standards and Specifications in the Wood-Using Industries," was published in 1927. The second volume contains 680 pages as compared with 349 in the first volume. Each of these volumes contains all nationally recognized standards, specifications, and simplifications within its scope, presented either in full or by means of suitable abstracts, tabulations, or cross references. It also contains methods of testing incidental to

the formulation of commodity specifications, which forms an exceedingly important part of the work.

Somewhat more than 50 per cent of the manuscript for the third volume of the Encyclopedia, "Standards and Specifications for Metals and Metals Products," has been completed. It is estimated that this volume will occupy about 1,100 pages.

Publication.—Standards and Specifications for Nonmetallic Minerals and Their Products, B. S. Miscellaneous Publication No. 110; 1930.

Federal Specifications and Testing.—Of the 700 specifications that have been promulgated by the Federal Specifications Board, approximately 300 have been prepared by, or with the active cooperation of the bureau's division of organic and fibrous materials. The work of this division, therefore, illustrates the work of the bureau as a whole. During the past year the committees on rubber products and packing materials have prepared 46 specifications and the division has assisted in the preparation of 40 specifications for textiles, 14 for paper, and 2 for leather.

The practical value of a specification is dependent largely upon the thoroughness with which it is enforced. An important part of the bureau's work is devoted to the inspection and testing of supplies purchased by the various Government agencies, and it is necessary to direct particular attention to the development of testing apparatus and methods of physical and chemical tests as a means of promoting standardization. During the past year the division of organic and fibrous materials has tested approximately 11,000 samples of miscellaneous materials, representing purchases by the various Government agencies.

SPECTROSCOPY AND ATOMIC STRUCTURE, RADIUM

Standard Wave Lengths.—The investigation of the spectra of Krypton and Xenon in connection with the possibility of using certain of their spectral lines as standards of wave length has been actively continued. The hyperfine structure of the spectra of these elements, which has an important bearing on their suitability as standards, was investigated by both the Fabry-Perot interferometer and the Lummer-Gehrcke plate. The results proved gratifyingly consistent.

Publications.—Interference Measurements in the First Spectra of Krypton and Xenon, by C. J. Humphreys, B. S. Jour. Research, vol. 5, No. 5, p. 1041· November, 1930.

Hyperfine Structure in the First Spectra of Krypton and Xenon, by C. J. Humphreys, B. S. Jour. Research, vol. 7, No. 3, p. 453; September, 1931.

Spectrochemical Analysis.—Several hundred samples of materials were analyzed, a large part of which were iridium and rhodium sponges prepared by the bureau in an attempt to obtain these metals in a higher state of purity than ever before accomplished. The effectiveness of the various chemical methods used was tested by the spectrographic analysis, leading to final products of almost spectroscopically pure metals.

Radium Testing.—Two thousand four hundred preparations of radium, more than double the number reported last year, totaling over 20,000 milligrams of the element, and fixing the sale value of about $1,300,000, were tested.

STONE

Elastic Pointing Materials.—The apparatus installed last year for testing elastic pointing materials for masonry has given good service, and about 300 samples of this material have been tested for Government departments during the year. The sudden increase in products of this nature has brought on the market a great number of new compositions. The test procedure now in use consists in determining if the materials form a satisfactory seal between masonry units when subjected to a slight separation comparable to structural movements; if staining occurs when the material is used on limestone; and if it will remain in a vertical joint when heated to 125° F. Although a large percentage of the compounds now on the market fail to meet these requirements, there is evidence of improvement in quality.

Slate Investigation.—The study of weathered roofing slate in connection with laboratory methods has shown that the weathering process is a combination of chemical and physical action. Frost has been found to play a very minor part in slate decay. With this information it has been possible to devise a weathering test which simulates the actual weathering forces. Cooperation with the Federal Specifications Board has led to the development of a specification for roofing slate which gives promise of securing a more uniform product.

Physical test data have been tabulated on 338 samples of domestic slate, mostly from the principal producing districts in Maine, Vermont, New York, Pennsylvania, and Virginia. This will be presented for publication at an early date. The report will cover flexural strength and elasticity of the slate in the dry and wet conditions, toughness, hardness, absorption, porosity, specific gravity, and weathering tests. Considerable space will be given to the nature of weathering processes found in this material, since this appears to be the most important consideration in connection with the development of a satisfactory roofing-slate specification.

SUGAR

Oxidation of Sugars.—A new process which promises to be of great commercial importance and has long been sought has been developed for the manufacture of sugar acids and their salts. When it is desired to produce a salt the sugar is electrolytically oxidized in the presence of a bromide and a base. The bromide is continuously regenerated; hence a small amount will facilitate the oxidation of a large quantity of sugar. Since the raw materials are cheap, the new process has considerable commercial possibility for the manufacture of calcium gluconate and similar products.

Publication.—The Oxidation of Sugars. The Electrolytic Oxidation of Aldose Sugars in the Presence of a Bromide and Calcium Carbonate, by Horace S. Isbell and Harriet L. Frush, B. S. Jour. Research, vol. 6, No. 6, p. 1145; June, 1931.

Standardized Regulations. Tariff Act of 1930.—Schedule E, sugars and molasses, is the largest producer of revenue in the tariff act. Much time was devoted by the bureau in carrying out the necessary

investigations requested by the Congress during the formation of the tariff act of 1930. The bureau has long acted in such an advisory capacity and is entrusted by the Secretary of the Treasury with the preparation of regulations for carrying out the provisions of the tariff act. In the tariff act of 1930 a radical change was made in the method of assessing duty upon molasses. The component of chief value in a molasses is the total amount of sugar and the new tariff act orders the collection of the revenue on the total number of pounds of such sugar. This procedure necessitates changes in methods employed. These methods have been finally perfected and standardized after extensive experimentation, and in collaboration with the Bureau of Customs the necessary revision of the customs regulations has been made. The importation of so-called liquid sugars of high purity necessitated investigations for methods applicable to these products. A satisfactory method has been finally developed, combining polarimetric and refractometric determinations.

Preparation of Crystalline Ribose.—Because of the widespread occurrence of ribose in plant and animal tissues this sugar is of great importance in the study of the physiological processes which take place in the human body. It occurs in combination with phosphoric acid and certain nitrogeneous compounds known as purines and pyrimidines in the nucleus of living cells. The cost of production is so high, approximately $16,000 per pound, that in spite of its importance little attention has been given to this sugar. The bureau has undertaken a study of ribose for the purpose of reducing its cost by improving methods of production, and at the same time obtaining information on its physical and chemical behavior and its relation to other sugars. A quantity of pure sugar has been obtained and an improved method of preparation developed which has resulted in a materially lowered cost.

Method of Levulose Manufacture.—The development of a semifactory-scale plant for the production of hard refined levulose was actively continued. The development of a satisfactory technique for a continuous-flow process is a difficult problem. It is especially difficult when there is no precedent to be used as a guide either in developing a suitable chemical control or in the design of the great variety of equipment required. Nevertheless, gratifying results have been obtained in this work. Certain portions of the factory were partially operated on a considerable scale, and data secured to redesign unsatisfactory equipment. Among the more important new pieces now completed and in operation may be mentioned (1) converter temperature control, (2) automatic defactor control, (3) calcium levulate crystal-grower, and (4) carbonator and filter assembly.

Structure of Sugars.—Numerous new sugar derivatives have been prepared in the course of studies relating to the molecular structure of the sugars. The separation of certain intermediate products in the reaction of the gamma acetyl methyl glycosides with hydrogen chloride shows that this reaction follows an entirely different course from what was previously believed. This reaction, as well as other reactions which were studied, support the ortho ester structure for these sugar derivatives. For testing the possible relationship between optical rotation and atomic dimension, compounds containing several asymmetric carbon atoms (derived from carbohydrates) have

been used. As the results suggest the testing of the relationship for compounds containing only one asymmetric carbon atom, experiments for the preparation of these compounds have already been started.

Publications.—A New Crystalline Calcium Chloride Compound of Alpha-*d*-Gulose and Its Rotation and Mutarotation in Aqueous Solution, by H. S. Isbell, B. S. Jour. Research, vol. 5, No. 3, p. 741; September, 1930.

The Ring Structure of Mannose. The Optical Rotation of 4-Glucosido-Alpha-Mannose, by H. S. Isbell, B. S. Jour. Research, vol. 5, No. 5, p. 1179; November, 1930.

Application of the Fluorating Process to Fructose, by D. H. Brauns and Harriet L. Frush, B. S. Jour. Research, vol. 6, No. 3, p. 449; March, 1931.

The Nature of Inulin.—This starch-like substance is of importance because of its wide distribution in the roots of plants and because it is the most available source of the sweet sugar, levulose. An investigation of this substance led to the discovery of a group of three new disaccharides, all of which have been isolated in pure crystalline form, and their physical properties described. A chemical study has shown them to consist of 2 molecules of levulose condensed with the loss of 2 molecules of water, from which fact they have been designated difructose anhydrides. In the investigation of their chemical properties eight new derivatives of these sugars have been prepared.

Publications.—Note on the Individualities of Anhydrofructose and Difructose Anhydride, by R. F. Jackson and S. M. Goergen, B. S. Jour. Research, vol. 5, No. 3, p. 733; September, 1930.

The Constant Occurrence of Nonreducing Disaccharides in Hydrolyzed Inulin, by R. F. Jackson and Emma McDonald, B. S. Jour. Research, vol. 5, No. 5, p. 1151; November, 1930.

Two New Crystalline Difructose Anhydrides from Hydrolyzed Inulin, by Richard F. Jackson and Emma McDonald, B. S. Jour. Research, vol. 6, No. 4, p. 709; April, 1931.

Color in the Sugar Industry.—Simplified methods in which spectrophotometric principles are applied have been worked out for the measurement of color in both solid and liquid sugar products, employing well-known laboratory apparatus and furnishing results of satisfactory accuracy with small expenditure of time. A colored glass of American manufacture when carefully calibrated serves as a standard for the colorimetry of liquid sugar products. A polarizing photometer with standardized conditions as to preparation of sample, illumination, etc., permits the measurement of light reflected from solid sugars.

Publication.—Color in the Sugar Industry. III. Preparation of Asbestos for Use as a Filter Aid, by J. F. Brewster and F. P. Phelps, Ind. Eng. Chem. (analytical edition), vol. 2, p. 373; October 15, 1930.

TEXTILES, DYES, CLEANING, ETC.

Fastness to Light of Dyed Textiles.—The bureau and the American Association of Textile Chemists and Colorists have been cooperating for over seven years in the development of standard methods for testing the fastness to light of dyed textiles. Notable progress has been made during the past year, especially in the selection of a series of standards for the different degrees of fastness. The relative fastness to light of 1,197 cotton, wool, silk, and weighted silk dye-

ings representing 366 dyestuffs, when exposed to sunlight in the standard "sun test" of the association were tabulated and classified into seven fastness classes.

Mercerization of Cotton for Aeronautical Purposes.—A mercerizing machine for studies under strictly controlled conditions was built. The effect of the factors, tension during mercerization, time of mercerization, temperature of the mercerizing bath, and concentration of caustic were studied. This work should lead to a specification for the conditions of mercerization which will result in the maximum strength for a given weight.

Cotton Fabric for Parachutes.—The work on the development of a cotton parachute cloth for use as a substitute for silk in the event of a national emergency curtailing the supply, was completed. Cotton yarn of high strength in proportion to its weight and otherwise specially suitable for parachute cloth was developed. Cloth woven from this yarn in the bureau mill was equal or superior to parachute silk in strength and tear resistance, met the requirements with respect to air permeability, and weighed only a few tenths of an ounce per square yard more than the silk cloth, and offers opportunity for substantial economy in price. Practical trials of cotton parachutes carried out by the Navy Department clearly indicated that the cotton parachute closely approaches the silk parachute in performance as to rate of descent, opening time, strength, and ability to function after storage in the pack. A specification for cotton parachute cloth and the way in which the requirements of the specification have been met are given in a report published by the National Advisory Committee for Aeronautics.

Publication.—An Investigation of Cotton for Parachute Cloth, by W. D. Appel and R. K. Worner, National Advisory Committee for Aeronautics Technical Note No. 393; September, 1931.

Hosiery for Aviators.—At the request of the Bureau of Aeronautics, Navy Department, a study of hosiery which appeared suitable for use by aviators in winter flying was made and a specification for hosiery for this purpose was developed.

Properties of Knit Underwear.—Knit fabrics are made from many combinations of fibers, yarn sizes, constructions, weight, and thickness. In order to obtain basic information regarding the effect of these variables on such fabric properties as air permeability, thermal transmission, coefficient of friction (inverse of slipperiness), and moisture permeability, comparable samples of knit underwear fabrics of about 100 different constructions were tested. When the results have been summarized and collated they should point the way to specifications for underwear of superior qualities.

Silk.—An accelerated laboratory aging test to show how weighted silk may be expected to age in service was developed. It was found that there is good agreement between the effects of exposure of silk to a carbon arc light for a few hours under certain conditions of temperature and humidity and those of exposure to a north light for several months (natural aging).

Special Test Methods for Textiles.—A study was made of the new apparatus for rapidly measuring the thermal transmission of fabrics. This apparatus is simpler to construct and to operate than the earlier apparatus. It requires a smaller sample for test, is compact and

portable, and gives results more rapidly. The values obtained were in good agreement with those obtained with previous equipment and by different methods in other laboratories. It is expected that it will be of considerable utility in the standardization of such textiles as blankets and clothing.

Further work on standardization of methods for evaluating stiffness, resiliency, and wrinkleability of cloth was carried out. A thickness gage applicable to the measurement and standardization of the softness or hardness of cloth and its recovery from compression was designed.

THERAPEUTIC ACCESSORIES

International Comparison of X-Ray Standards.—The International Congress of Radiology adopted at their 1928 meeting the ionization chamber method as their standard method for measuring X-ray intensities. It is based on the fact that air is rendered electrically conductive when traversed by a beam of X rays, and this in a degree closely proportional to the X-ray intensity (power) and but slightly variable with the hardness (wave length). This proportionality to the intensity can be corroborated by merely measuring the ionization (electrical conductivity) at different distances from a constant source of X rays. With reliably calibrated electrical instruments readily available, the qualifications of the method for adoption as a standard are therefore obvious. The radiologist's unit of intensity of X rays, the Roentgen, is defined then as that which imparts a specified electrical conductivity to air in a specified electrical set-up (ionization chamber). Certain details of the ionization chamber were left open in the above-mentioned specification, to be worked out by the standardizing laboratories. This has been done very completly at the bureau, where both a full-sized ionization equipment and also a more compact portable outfit have been developed and tried out with very satisfactory results. The portability of the latter made comparisons possible with other laboratories, especially with the National Physical Laboratory of Great Britain and the Physikalisch-Technische Reichsanstalt of Germany. These, carried out recently, proved very satisfactory. A report of them at the 1931 meeting of the International Congress of Radiology resulted in the adoption of definite specifications for the ionization chamber outfit which are entirely fulfilled by the bureau's present equipment.

Publications.—The Problem of International X-ray Standardization, by L .S. Taylor, Radiology, vol. 14, p. 551; 1930.

Calibration of the Fingerhut Ionization Chamber, by L. S. Taylor and G. Singer, B. S. Jour. Research, vol. 4, No. 5, p. 631; May, 1930.

An Improved Form of Standard Ionization Chamber, by L. S. Taylor and G. Singer, B. S. Jour. Research, vol. 5, No. 3, p. 507; September, 1930.

Apparatus for the Measurement of High Constant or Rippled Voltages, by L. S. Taylor, B. S. Jour. Research, vol. 5, No. 3, p. 609; September, 1930.

Recent Progress in X-ray Standardization, by L. S. Taylor, Radiology, vol. 16, p. 1; 1931.

Further Studies of the X-ray Standard Ionization Chamber Diaphragm System, by L. S. Taylor and G. Singer, B. S. Jour. Research, vol. 6, No. 2, p. 219; February, 1931.

Accurate Measurement of Small Electric Charges, by L. S. Taylor, B. S. Jour. Research, vol. 6, No. 5, p. 807; May, 1931.

Absorption Measurements of the X-ray General Radiation, by L. S. Taylor, B. S. Jour. Research, vol. 5, No. 3, p. 517; September, 1930.

Method for Measuring Ultra-Violet Radiation.—With the use of ultra-violet radiation for health purposes the demand for a reliable method of measuring this very difficult quantity has arisen. The bureau has cooperated with several other laboratories during the past year in measuring the ultra-violet output of the same samples of a specific type of lamp. Considerable difference in the measurement by these different laboratories appears to arise from both the inconstancy of the lamps and the inaccuracy of the measuring methods. For this purpose the bureau has developed a balanced thermocouple and filter method which appears very promising.

Publication.—A Balanced Thermocouple and Filter Method of Measuring Ultra-Violet Radiation, by W. W. Coblentz, R. Stair, and J. M. Hogue, B. S. Jour. Research, vol. 7, No. 4, p. 723; October, 1931.

THERMAL EXPANSION MEASUREMENTS

Thermal Expansion of Heat-Resisting Alloys (Nickel-Chromium, Iron-Chromium, and Nickel-Chromium-Iron Alloys).—An investigation of the linear thermal expansion of the important heat-resisting alloys manufactured in the United States, has been completed. These alloys are being used extensively in constructional projects where resistance to oxidation is required.

Thermal Expansion Apparatus.—The demand for details of the fused quartz expansion apparatus designed by the bureau for use in commercial laboratories, has continued. This apparatus enables firms to do most of their ordinary expansion testing and is giving satisfaction wherever installed. Information and blue prints will be supplied upon request.

An autographic expansion apparatus is being developed at the bureau. Details will not be available until sometime in 1932.

Publications.—Thermische Ausdehnung von Magnesium and Magnesiumlegierungen, by P. Hidnert and W. T. Sweeney (translated into German by Dr. Ing. Max Haas, Aachen, Germany), Zeitschrift fur Metallkunde, vol. 21, p. 207; 1929.

Thermal Expansion of M-M-M Alloy, by Peter Hidnert and W. T. Sweeney, Physical Review, vol. 36, p. 787; Aug. 15, 1930.

The Properties of Pure Nickel (Section on Thermal Expansion), by P. Hidnert, B. S. Jour. Research, vol. 5, No. 5, p. 1291; December, 1930.

Thermal Expansion of Heat Resisting Alloys, by Peter Hidnert, Thesis for Ph. D. degree, May, 1931, American University, Washington, D. C.

TIME MEASURING AND RECORDING INSTRUMENTS

Precision Clock.—The precision clock mentioned last year, especially adapted to use with the photo-electric cell, has been constructed and installed in the constant temperature clock room. This clock, which has a free pendulum, has been found to give seconds signals of a higher accuracy than those obtained from the Riefler clock.

Effect of Temperature Changes on Rates of Watches.—The bureau has cooperated in a research to determine the relative merits of the cut, bimetallic balance, and steel hairspring as compared with the uncut, monometallic balance, and elinvar hairspring. Preliminary results indicate that watches equipped with the latter type can be more accurately adjusted to compensate for temperature changes than can the ordinary watch of the same grade.

Cooperation with Horological Institute.—The bureau has continued to cooperate with the Horological Institute of America in its efforts to improve the quality of service rendered by watch repairmen. The bureau tests the repaired watches submitted by candidates as a part of the examination for qualification as junior watchmaker and certified watchmaker.

WASTE PRODUCTS FROM THE LAND

Preparation and Testing of Starch Sizes.—In the investigation of the adaptability of sweetpotato starch as a sizing material in the textile industry it has been found desirable to study the methods of preparing sizes and also methods of testing starch and starch solutions which are to be used for this purpose. It was found that long heating of starch solutions accompanied by agitation and high temperatures decreases the consistency of the solution and that the heating should be kept down to a minimum, both as to the temperature and the time of heating, if a high consistency is desired. Experimental results indicate that a standardized centrifuging test may be suitable for determining the homogeneity of starch solutions. Other experiments indicate that the viscosity, conductance, and precipitation by alcohol may also be used to determine the value of starch for sizing purposes.

Standardization of Xylose.—In the production of xylose in the plant at Anniston, Ala., in cooperation with the Swann Corporation and the State industrial commission an excellent commercial grade was manufactured. It is inevitable, however, that the xylose becomes contaminated with traces of iron, nickel, copper, and lead from the equipment, and of calcium, magnesium, sulphates, and other salts from the chemicals used. Although of no consequence in ordinary commercial or laboratory uses of xylose, some of these impurities are harmful when this sugar is used by humans for certain purposes which are being investigated in cooperation with a number of medical authorities. It, therefore, became necessary to devise methods for standardizing the removal of such impurities to below 5 parts per 1,000,000. It was found that these heavy metals can be precipitated from slightly alkaline solutions of xylose by treatment with small quantities of sodium phosphate or hydrogen sulphide. The sugar sirup thus treated is filtered, slightly acidified, decolorized by percolation through ash-free activated carbon, concentrated by evaporation of part of the water in vacuum, seeded with powdered pure xylose, and cooled and stirred for 24 hours. White xylose is thus obtained which shows the absence of even traces of such deleterious impurities when tested chemically and when fed to humans or animals in large quantities. A large number of requests was received for the mimeographed directions for the purification of xylose by this method.

Purification of Crude Cottonseed Oil.—A method was developed for small scale or home purification of crude cottonseed oil for edible purposes. These edible oils should meet certain standard specifications as to color, odor, free acid, unsaturation or iodine number, and volatile impurities. By agitating the crude oil with required amounts of caustic-soda solution and cooling the mass, the rancid

fatty acids are removed and settle as soap. The oil is then boiled with water one hour to remove the volatile matter responsible for objectionable odor and taste. When the oil is separated and heated with Fuller's earth and filtered; it forms a slight-yellow product suitable for frying, shortening, and salad dressing. Both dark and white soap can be made. A mimeographed circular giving complete directions has been in wide demand.

Standardization of pH Tests for Acidity.—The best use of commercial processes and the properties of the products are often dependent upon the presence and regulation of minute amounts of acid or basic materials. This acidity or so-called pH value is measured by making a definite mixture of the product and a suitable indicator or dye; the pH value is obtained when the color is matched with one of a series of graded pH color standards. When the concentration and acidity of the product are very low the acidity of the added indicator may cause errors in the preliminary pH test. The final pH test is therefore made by adding indicator having a pH value or acidity practically equal to that given in the preliminary test of the product. This so-called isohydric (equal acidity) indicator method has been widely used and adopted by commercial firms selling indicators. An illustration of its usefulness is given in the tests of acidity of papers required by the Government Printing Office. It was found by three Government laboratories and others that different commercial firms sold indicators of various pH values or acidities which, therefore, gave different pH values in the very dilute or weakly buffed extracts of paper. When the isohydric-indicator method was employed nearly identical pH values were obtained by all workers. The method is now widely used and is being studied by T. A. P. P. I. in conjunction with other tests. Numerous requests have been received for advice and for articles on this subject.

Investigation of the Sulphate Process.—This investigation is directed toward the elimination of objectionable components in the blow-off gases, or at least minimizing the evil resulting from the discharge into the air of poisonous and odoriferous gases from the digesters in the sulphate pulping process. Analytical methods for the determination of the sulphides and mercaptans have been studied, as well as the absorption of such gases by silica gel and absorbent carbons. Some progress has been made, but the work is not yet completed and is still in progress.

WEIGHTS AND MEASURES

Weights and Measures Conference.—The Twenty-fourth National Conference on Weights and Measures met at the bureau on June 2 to 5, with a representation from 25 States and the District of Columbia. A tentative code of specifications and tolerances for person weighers was adopted, the code for odometers was adopted in final form, modifications were made in a number of codes formerly adopted, chiefly affecting lubricating-oil bottles, grease-measuring devices, and various types of weighing scale. A distinction was set up between requirements intended to be met by the equipment manufacturer and those directed toward the user of apparatus; the latter

class—that is, maintenance requirements—will henceforth be known as "regulations" as distinguished from "specifications," and will be grouped under that heading.

Numerous technical papers dealing with different phases of weights and measures regulation were presented to the conference by speakers representing weights and measures officials, manufacturers of commercial equipment, industry, and departments of the Federal Government. There were also demonstrations of recent developments in weighing scales.

Publication.—Report of the Twenty-Fourth National Conference on Weights and Measures, B. S. Miscellaneous Pub. No. 129; 1931.

Certification of Master Gages.—One of the important projects completed during the year was the remeasurement of the American Petroleum Institute's grand and regional master cable tool-joint gages. Many of the ring gages were found to be outside of tolerances on lead of thread, and the American Petroleum Institute arranged for correction of the gages by the gage maker. Complete sets for two sizes of joints have been corrected and remeasured. The remaining nine sets will be corrected and recertified during the summer and fall.

Gages for Interchangeable Ground-Glass Joints.—The manufacturers of ground-glass joints replaced the original master plain taper gages which, as mentioned in the 1931 Yearbook, were found unsatisfactory, with more accurate gages made in this country. These were checked and found to meet the requirements.

Cooperation with the National Physical Laboratory and the Physikalisch-Technische Reichsanstalt.—Foreign manufacturers of oil-field equipment are using A. P. I. standards to a large extent, and the American Petroleum Institute has appointed both the National Physical Laboratory of England and the Physikalisch-Technische Reichsanstalt of Germany as official testing agencies for A. P. I. gages made in Europe. This has led to considerable correspondence between the bureau and these laboratories with regard to interpretation of A. P. I. gage specifications and standardization of methods of test.

Survey of Screw-Thread Practice in the United States.—The American national standards for screw threads for bolts, machine screws, nuts, and tapped holes, as embodied in Section III of the Report of the National Screw Thread Commission (B. S. Misc. Pub. No. 89) and in Report B1a–1924 of the American Standards Association, have been in use for 10 years, with certain minor changes.

In order to provide information for a revision of the present standard, if necessary, so that it will better serve the needs of manufacturers and users of screw threads, the bureau is cooperating in a field survey of screw-thread practice under the auspices of the sectional committee on the standardization and unification of screw threads organized under the procedure of the American Standards Association and sponsored by the American Society of Mechanical Engineers, Society of Automotive Engineers, and the National Screw Thread Commission. The investigation is intended to show: (1) The actual state of screw-thread standardization in the United States at the present time, (2) the range of accuracy desirable for an acceptable product of a given class, and (3) the range of accuracy commercially attainable. This information will be derived from

measurements of the various elements which govern screw-thread fits.

A total of 7,561 samples of bolts, screws, and nuts has been collected from 128 manufacturing plants located in the area east of the Mississippi and north of the Ohio and Potomac Rivers, selected as being representative manufacturers and consumers of threaded products. Samples consist of 12 different sizes ranging from No. 6–32 to 1¼″–7 in the coarse thread series and from ⅜″–24 to 1″–14 in the fine thread series. The samples were selected at random in groups of five of each size at each source.

The investigation has progressed to the point where measurements of the bolts and screws, of which there are 4,055, are practically completed. Four measuring or gaging operations are performed on each sample, namely, (1) gaging by means of thread snap gages to determine the class of fit; (2) measurement of major diameter; (3) measurement of pitch diameter; and (4) examination in an optical screw thread comparator to determine by optical projection of the thread onto a chart the class of fit, amount of lead error, character of thread form or finish, including error in angle, and whether the minor diameter is within specified limits. In this last operation a photographic record of the thread shadow superimposed on the chart is also made of the sample selected as representative of each group of five.

About one-third of the nuts received have been gaged as to class of fit and minor diameter, and work on these is progressing. Casts of some of the nut threads will be made and examined in the projection comparator, but as this will be slow and laborious the extent to which this test will be carried has not been determined.

The results of the investigation, when available, will be released through the chairman of the above-mentioned sectional committee.

Action of International Committee on Weights and Measures with Reference to Standard Temperature.—At the April, 1931, meeting of the International Committee of Weights and Measures a resolution was passed approving the use of 20° C. (68° F.) as the standard temperature for all industrial length measuring instruments, gages, etc. This is a very important step toward international uniformity and interchangeability of parts.

Nickel-Chromium Alloy for Weights.—A research to determine the suitability of an alloy of 80 per cent nickel and 20 per cent chromium as a material for high-precision standards has been prosecuted during the year by studying the accuracy and behavior of weights made of this material, under a variety of conditions to which standards may be subjected in practice. Thus far the material seems to be of satisfactory constancy.

Ethyl Alcohol Tables.—A new series of ethyl alcohol density tables was prepared at the request of the Association of Official Agricultural Chemists for publication in their Methods of Analysis. These tables are based on the original research carried out at the bureau some years ago. The new tables are on the basis of percentage by volume, whereas the earlier publication was on the basis of percentage by weight.

Density of Creosote Oils.—The work on creosote oils and creosote coal-tar solutions has been continued in cooperation with the pre-

servatives committee of the American Wood Preservers Association, and volume correction tables have been prepared for use with representative commercial solutions.

Orifice Meter Tests.—Progress has been made in reviewing and correlating data on the several research projects involving orifice discharge coefficients and large capacity gas meters, and some of this material is now ready for publication. The subject of pulsating flows is now under consideration and the work done in this field is now being reviewed preparatory to outlining the scope of the research which will be undertaken.

VII. MUNICIPAL, COUNTY, AND STATE PURCHASING AGENCIES

Information relating to the methods of making specifications and purchasing commodities used by the various agencies of the Federal Government is set forth in Chapters V and VI. Important as are the purchases of the above-noted agencies, they are not more important than those of the municipal, county, and State agencies, the combined purchases of which are several times as great as the purchases of the Federal Government. All of the money spent by these agencies is collected from the public in the form of taxes.

In order to determine in what way the Federal agencies can best be of assistance to the local agencies intrusted with the expenditure of public money, periodic surveys have been made of the extent to which purchasing departments use the specifications method of buying, the manner in which standards and specifications are formulated, and the methods employed in checking and inspecting deliveries to determine whether or not they comply with the specification requirements.

The surveys indicate an increasing use of worth-while specifications, a greater reliance on nationally recognized specifications, and a more widespread utilization of the testing facilities afforded by the laboratories of colleges and universities. For example, specifications in conformity with those of the American Society for Testing Materials, the American Association of State Highway Officials, and the U. S. Bureau of Public Roads are in practically universal use by the State highway commissions who are spending money obtained locally and from the Federal Government in improving the highways of the country. The magnitude of the purchases will be appreciated when it is learned that the total expenditures through the State highway departments in 1930 were $980,000,000.

MUNICIPAL PURCHASING AND STANDARDIZING AGENCIES

Information relating to their purchasing methods had been received from all cities in the country having a population of 300,000 or more, and from 219 of the 254 cities having a population in excess of 30,000. Of these cities, 77 have the council-manager form of government. This form is used by municipalities of various sizes, including cities having populations exceeding 1,000,000 and towns of less than 1,000 inhabitants.

During the year 1930 and up to October 1, 1931, the following cities adopted the council-manager form of government: Oakland, San Diego, Upland, and Ventura in California; Jacksonville, Pensacola, and St. Petersburg in Florida; Wilmet, Ill.; Arkansas City, Kans.; Covington, Lexington, and Newport, Ky.; Bangor, Brewer, Dexter, Mount Desert, and Washburn in Maine; Teaneck, N. J.; Binghamton, N. Y.; Mamaroneck, N. Y.; Asheville, N. C.; Bed-

ford, Ohio; Cleveland and Shawnee, Okla.; Phoenixville, Pa.; Belton, Borger, Dallas, and Jacksonville in Texas; Appalachia and Front Royal, Va.; and Fort Atkinson, Wis.

Outlines of their methods of formulating and using specifications have been received from 283 of the 401 cities and towns now having city managers. Reports have been received from 320 additional cities and towns having populations of from 2,500 to 30,000.

In all of the larger cities, most of the specifications utilized are prepared by officers of the cities in consultation with the using agencies. In preparing the specifications considerable use is made of nationally recognized specifications, those most commonly selected being the specifications of the American Society for Municipal Improvements, the American Water Works Association, the American Society for Testing Materials, and the Federal Government.

More than 60 per cent of the cities and, perhaps, less than 25 per cent of the towns reporting have made arrangements with laboratories for commodity acceptance testing. A large percentage of the cities utilize college and university laboratories or commercial testing laboratories for this purpose, although 90 of the cities maintain their own laboratories for testing certain commodities.

Inspection, more or less effective, is resorted to by practically all of the cities, several of which engage special personnel for the work.

Cities reporting economies in purchasing attribute these economies to the use of definite specifications and to the introduction of the centralized method of buying. Reported savings range from 4 to 30 per cent, with savings on individual items running as high as 50 per cent.

COUNTY PURCHASING AGENCIES

Taken as a whole the governments of the counties of the country, of which there are more than 3,000, are not well organized from the point of view of purchasing and the use of standards and specifications. However, in the county governments in several of the States and in counties scattered throughout the country considerable progress has been made in introducing good business methods in the governments.

Although the county governments operate without direct control of the State governments, usually the counties are regulated by laws established by the States. Within certain limits each county is free to determine for itself the method of conducting its business transactions best suited to its needs or desires, the result being that there are great differences between the purchasing methods and business procedures employed even in adjacent counties in the same State.

Below there is given an outline of the results obtained from a recent survey of the methods used in the counties in the United States.

Questionnaires asking for information relating to their specifications making and purchasing methods were sent to the government offices of about 3,000 counties. The replies showed that in only a small percentage of the total number of counties in a few States is any attempt being made by the county officials to systematize the purchasing procedure. However, very progressive purchasing

methods are employed in a considerable number of the counties of certain States.

In Alabama counties purchases are made or approved usually by the county commissioners, the board of revenue, or the judge of probate. However, in Jefferson and Tuscaloosa Counties all departments of the county governments make their purchases through a single agent who also purchases the materials used in county road building.

Purchases in Arizona counties are usually made by the board of supervisors. However, in Pima County purchases for all departments are made by a purchasing agent, with estimated savings 22 per cent over former methods.

The county judge usually has full authority for making purchases for the county government in Arkansas.

California has passed laws permitting the counties to adopt the county-manager plan of government, and to establish centralized purchasing. It has also passed a law requiring all school supplies to be bought through the county superintendent of schools or the county purchasing agent. Purchasing agents have been engaged in a large number of California counties, including Alameda, Butte, Contra Costa, Fresno, Imperial, Jackson, Kern, Kings, Lassen, Los Angeles, Marin, Monterey, Orange, Placer, Riverside, Sacramento, San Bernardino, San Diego, San Francisco, San Joaquin, San Mateo, Santa Barbara, Santa Clare, Sonoma, Stanislaus, Tulare, and Yolo. In Imperial, Lassen, Los Angeles, Monterey, Placer, Riverside, Stanislaus, and Tulare Counties the purchasing agents buy for all divisions of the government. Savings on school purchases are estimated at 25 per cent in Imperial and Lassen Counties. The estimated savings on all purchases in other counties range from 10 to 50 per cent, attributable to the adoption of the centralized system of buying.

Purchases for the county governments in Colorado, Delaware, Florida, Georgia, Idaho, Indiana, Kansas, Maine, Maryland, Massachusetts, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Washington, and Wyoming are made by or under the authority of the county commissioners and school superintendents. In many of the counties the road superintendents buy all road materials, and the county clerks make purchases for other divisions of the governments. In some of the counties of Georgia, the officer known as an "ordinary" acts as the purchasing agent. In certain Maryland counties purchases are made separately for the roads and the schools.

Boards of county commissioners in Massachusetts usually give authority to the heads of the various offices, departments, and institutions to make ordinary purchases for their respective units. In the case of the county of Nantucket the selectmen of the town of Nantucket, which is the same in boundary as the county, serve as, and are the county commissioners. In Suffolk County, which consists of Boston and three adjoining towns, the purchasing for the county is done through the Boston city government by the superintendent of the supply department.

In Illinois, Iowa, Michigan, Mississippi, New York, and Virginia purchases for the counties are made by the county boards of supervisors, organized under the laws of these States.

Judges and magistrates of the counties and the jailers make purchases for many of the counties in Kentucky.

Subdivisions of Louisiana are called parishes and not counties. Usually the buying for the parishes is done by the police juries. Other officers act as purchasing agents in Rapides and Vernon Parishes.

In Missouri and Oregon counties, purchases are made under the authority of the county courts, which usually consist of three judges.

In New Jersey the boards of chosen freeholders make purchases for the counties on recommendations of the heads of the different departments.

Each of the five counties which comprise the State of Rhode Island is laid off into from 3 to 16 towns, which include the whole area of the State. Purchases are made by the officers of the separate towns, but none by officers of the counties as such.

In many counties in Tennessee committees have been organized to handle the purchasing, while in others purchases are made under the authority of the county judges, who are the real purchasing agents.

An old law in Washington gives to the county auditor the authority to make purchases. Usually a budget is agreed upon by county commissioners.

Purchases for Wisconsin counties are usually made by the county clerk and the highway commissioner. To certain individual officers have been assigned the duties of purchasing agent in the counties of Ashland, Bayfield, Fond du Lac, Iowa, La Crosse, Marathon, Ozaukee, and Waupaca. Usually the purchases for the county highways are made separately.

The duties and responsibilities of the county officers differ widely in the separate States. In California, where the school supplies may be bought either through the superintendent of schools or the county purchasing agent, considerable savings are being attributed to centralized buying through the county purchasing office. In New York a movement is on foot to place the purchase of road materials under the county purchasing agents. In North Carolina the State highway commission has full authority for the construction and maintenance of all public roads, Federal, State, and county, except the streets of cities and towns.

STATE PURCHASING AND STANDARDIZING AGENCIES

Laws relating to the modernizing of the business methods of State government purchasing agencies have been passed from time to time covering various features which may be looked upon as steps in the development of the methods. In some cases definite dates can be set for outstanding developments, whereas in others changes in the laws have been made gradually.

Laws which at least permit centralized purchasing, with varying degrees of inclusiveness throughout the State governments, have

been enacted in the following States: Alabama (1915 and 1923); Arizona, Arkansas, California (1915, 1921, and 1927); Delaware (modified); District of Columbia, Idaho (1919 and 1927); Illinois (1917 and 1925); Iowa (1898 and 1929); Florida (State institution); Indiana (institutions); Kansas (1927); Kentucky (1926); Maine (1931); Maryland (1920–1923); Massachusetts (1919 and 1922); Michigan (1921); Minnesota (1925); Montana (1921); Nebraska (1919); New Hampshire (1913, 1917, and 1919); New Jersey (revised 1931); New York (1927 and 1930); North Carolina (1931); North Dakota, Ohio (1921); Oklahoma (1910); Oregon (1927); Pennsylvania (1923–1929); Rhode Island (1922); South Dakota (1925); Tennessee (1923); Texas, Utah (1927 and 1931); Vermont (1912 and 1923); Virginia (1927); Washington (1921); West Virginia (1915); and Wyoming. It will be noted that the first State to adopt centralized purchasing was Iowa, and the latest Maine and North Carolina.

An excellent example of the progress recently made in developing State government purchasing methods is found in North Carolina, which has adopted many of the best methods employed separately in the other States. The changes introduced in that State involve not only the purchases made by the State government departments, but also those of the counties, and they cover both the highways and the schools. The State highway commission has been reorganized, and all district lines and district representatives have been eliminated. For administrative purposes the State has been divided into 25 districts arranged in five divisions.

In the operation of the public-school system, the State becomes the unit of administration. All supplies are to be bought by the State central purchasing agency which was created by the 1931 legislature. However, the counties or districts are responsible for constructing and repairing the school buildings.

Through the division of purchase and contract, which is attached to the governor's office, the State will receive competitive bids on all purchases of supplies, materials, and equipment for the departments and institutions, including the highways and the public schools. The governor has expressed the opinion that the centralized purchasing agency will prove of tremendous value in efficient service and commercial buying, and will effect a saving of from $400,000 to $500,000 annually. He estimates that, by reason of the changes recently introduced, the total cost of operating the State government in North Carolina will be reduced 10 per cent.

In several States, notably Iowa, Kansas, and Michigan, the State governments have been authorized to assist in constructing and maintaining the roads in cities, towns, and townships which are designated as connecting links in the State road systems.

Although not listed among the States that have introduced the centralized buying method, Missouri has taken an important step in revising its purchasing methods. On April 27, 1931, the Missouri State legislature passed a bill in accordance with which all requests hereafter made for bids and proposals for materials, products, supplies, provisions, and other needed articles to be purchased in Missouri at public expense, are to be made in general terms and by general specifications and not by brand, trade name, or other individual

mark. The State maintains laboratories for the pure food and drug department, the State board of health, and the State oil inspection department. Both the State highway departments and the State universities and colleges maintain their own testing and inspection laboratories.

The following States base their purchases on definite specifications, and utilize State-owned laboratories, including those of the universities and colleges: Alabama, Arizona, California, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Texas, Utah, Vermont, Washington, West Virginia, Wisconsin, and Wyoming. The following States also use the specification method of purchase: Arkansas, District of Columbia, Florida, Kentucky, Michigan, Oklahoma, and Virginia. Use is frequently made of nationally-recognized specifications prepared by the technical societies, trade associations, and the Federal Government, modified to meet local conditions when found necessary.

ALPHABETICAL LIST OF STATE PURCHASING AGENCIES

In the following brief items there are set forth the names and addresses of the State purchasing and standardizing agencies, including State highway departments and the chief officers concerned with the preparation of specifications and the purchase of materials, supplies, and equipment.

Alabama State Board of Administration, Montgomery. C. A. Moffett, president.

Alabama State Highway Department, Montgomery. Landon G. Smith, highway director.

Arizona Board of Directors of State Institutions, Phoenix. C. M. Zander, executive officer; secretary, State purchasing agent.

Arizona State Highway Department, Phoneix. C. E. Addams, chairman of commission; T. S. O'Connell, State highway engineer; J. P. Dillon, purchasing agent.

Arkansas State Highway Commission, Little Rock. Dwight H. Blackwood, chairman; Charles S. Christian, State highway engineer.

Arkansas State Purchasing Department, Little Rock. B. O. Johnson, purchasing agent.

California State Department of Finance, Bureau of Purchases, Capitol Building, Sacramento. J. F. Mispley, State purchasing agent.

California State Highway Department, Sacramento. Earl Lee Kelly, chairman; C. H. Purcell, State highway engineer.

Colorado State Educational Institutions, associated purchasing agents of, Boulder. Henry B. Abbett, chairman.

Colorado State Highway Department, Denver. Peter Seerie, chairman of commission; Charles D. Vail, State highway engineer.

Connecticut State Board of Finance and Control, Hartford. Edward F. Hall, commissioner.

Connecticut State Department of Health, Hartford. L. A. Fagan, purchasing agent.

Connecticut State Highway Department, Hartford. John A. Macdonald, State highway commissioner.

Delaware State Board of Supplies, Dover. Charles H. Grantland, secretary of state.

Delaware State Highway Department, Dover. F. V. du Pont, chairman of commission; W. W. Mack, chief engineer.

District of Columbia Purchasing Office, Washington, D. C. M. C. Hargrove, purchasing officer.

Florida Board of Commissioners of State Institutions, Tallahassee. Dan W. D'Alemberte, secretary.

Florida State Road Department, Tallahassee. Robert W. Bentley, chairman, of commission; B. M. Duncan, chief engineer.

Georgia State Department of Public Printing, State Capitol, Atlanta. Josephus Camp, superintendent.

Georgia State Highway Department, Atlanta. J. W. Barnett, chairman of commission; B. P. McWhorter, State highway engineer.

Idaho State Bureau of Supplies, Boise. R. G. Archibald, State purchasing agent.

Idaho State Department of Public Works, Boise. Alvin Harbour, commissioner of public works.

Illinois State Department of Public Works and Buildings, Division of Highways, Springfield. Harry H. Cleaveland, director, department of public works; Frank T. Sheets, chief highway engineer.

Illinois State Division of Purchases and Supplies, Statehouse, Springfield. A. W. Dailey, State purchasing agent.

Indiana State Highway Commission, Indianapolis. A. J. Wedeking, chairman of commission; John J. Brown, director of commission.

Indiana State Joint Purchasing Committee, Indianapolis. Daily E. McCoy, secretary.

Iowa Board of Control of State Institutions, Des Moines. E. J. Hines, secretary; H. L. Shropshire, purchasing agent.

Iowa State Highway Commission, Ames. C. C. Riepe, chairman of commission; Fred R. White, chief engineer.

Kansas State Board of Administration, Topeka. H. R. Rhodes, State business manager.

Kansas State Highway Commission, Topeka. C. T. Helvering, director of highways; W. V. Buck, State highway engineer.

Kentucky State Highway Commission, Frankfort. Ben Johnson, chairman of commission; H. D. Palmore, chief engineer.

Kentucky State Purchasing Commission, Frankfort. Andrew Alexander, State purchasing agent.

Louisiana State Board of Commissioners of the Port of New Orleans, New Orleans. Col. Marcel Garsaud, general manager.

Louisiana State Highway Commission, Baton Rouge. O. K. Allen, chairman of commission; H. H. Henderlite, State highway engineer.

Maine State Highway Commission, Augusta. Frank A. Peabody, chairman of commission; L. D. Barrows, chief engineer.

Maine State Purchasing Agents' Association, Augusta. Samuel N. Tobey, secretary.

Maryland State Central Purchasing Bureau, Baltimore. Walter N. Kirkman, State purchasing agent.

Maryland State Roads Commission, Baltimore. G. Clinton Uhl, chairman of commission; R. F. Going, purchasing agent.

Massachusetts State Department of Public Works, Statehouse, Boston. Frank E. Lyman, commissioner of public works; Arthur W. Dean, chief highway engineer.

Massachusetts State Purchasing Bureau, Statehouse, Boston. George J. Cronin, State purchasing agent.

Michigan State Administrative Board, Lansing. C. D. Betts, purchasing agent.

Michigan State Highway Department, Lansing. Grover C. Dillman, State highway commissioner; Frank F. Rogers, consulting engineer.

Minnesota State Department of Highways, St. Paul. Charles M. Babcock, commissioner of highways; J. T. Ellison, chief engineer.

Minnesota State Purchasing Department, St. Paul. Carl R. Erickson, purchasing agent.

Minnesota State Board of Control, St. Paul. Wm. A. Richards, purchasing agent.

Minnesota State Department of Public Institutions, Bureau of Purchases, St. Paul. C. J. Swenden, chairman; H. W. Austin, purchasing agent.

Mississippi Capitol Commission, Jackson. Walker Wood, secretary of state, director in charge.

Mississippi State Highway Department, Jackson. Brown Williams, chairman; G. A. Draper, State highway engineer.

Missouri State Highway Commission, Jefferson City. C. D. Matthews, chairman of commission; T. H. Cutler, chief engineer.

Missouri State Purchasing Agencies, Jefferson City. Gov. Sam A. Baker, chairman.

Montana State Highway Commission, Helena. O. S. Warden, chairman, Great Falls; R. D. Rader, State highway engineer, Helena.

Montana State Purchasing Department, Helena. J. E. Murphy, State purchasing agent.

Nebraska State Purchasing Department, Lincoln. Blaine L. Yoder, purchasing agent.

Nebraska State Department of Public Works, Bureau of Roads and Bridges, Lincoln. Roy L. Cochran, State engineer; A. T. Lobdell, chief, bureau of roads.

Nevada State Board of Capitol Commissioners, Carson City. Gov. Fred B. Balzar, chairman.

Nevada State Department of Highways, Carson City. Gov. Fred B. Balzar, chairman of commission; S. C. Durkee, State highway engineer.

New Hampshire State Highway Department, Concord. Edgar C. Hirst, commissioner of highways.

New Hampshire State Purchasing Department, Concord. W. A. Stone, purchasing agent.

New Jersey State Highway Commission, Trenton. H. L. Scott, chairman of commission; Jacob L. Bauer, State highway engineer; R. W. Wildblood, purchasing agent.

New Jersey Statehouse Commission, Trenton. Edward J. Quigley, purchasing agent.

New Mexico State Highway Department, Santa Fe. Frank L. Butt, chairman of commission; W. R. Eccles, State highway engineer; Frank Horn, purchasing director.

New Mexico State Officials, Santa Fe. R. C. Dillon, governor; Miguel A. Otero, jr., State auditor; Warner R. Graham, State treasurer; Lois Randolph, superintendent of public instruction.

New York Department of Public Works, Division of Highways, Albany. Frederick Stuart Greene, superintendent of public works; Arthur W. Brandt, commissioner of highways.

New York State Bureau of Standards and Purchases, Albany. Frank L. Morris, purchasing agent.

North Carolina Division of Purchase and Contract, Raleigh. Alfred S. Brower, director.

North Carolina State Highway Commission, Raleigh. E. B. Jeffress, chairman of commission; L. R. Ames, State highway engineer; W. Z. Betts, purchasing agent.

North Dakota State Board of Administration, Purchasing Department, Bismarck. J. B. Smith, State purchasing agent.

North Dakota State Highway Commission, Bismarck. G. F. Shafer, chairman; H. C. Frahm, chief engineer.

Ohio State Department of Finance, Columbus. Harry J. Rettig, purchasing agent.

Ohio State Department of Highways, Columbus. O. W. Merrell, director of highways; H. P. Chapman, chief engineer; Fred Sinsabaugh, purchasing agent.

Oklahoma State Board of Public Affairs, Oklahoma City. C. E. Dudley, chairman; J. Robert Gillam, secretary.

Oklahoma State Highway Commission, Oklahoma City. Sam R. Hawks, chairman of commission; A. R. Losh, State highway engineer; A. B. Thomas, purchasing agent.

Oregon State Highway Department, Salem. H. B. Van Duzer, chairman of commission; Roy A. Klein, State highway engineer; William Einzig, purchasing agent.

Oregon State Purchasing Board, Salem. William Einzig, purchasing agent.

Pennsylvania Department of Property and Supplies, Bureau of Standards and Purchases, Harrisburg. John D. Tompkins, director of standards and purchases.

Pennsylvania State Department of Highways, Harrisburg. Samuel S. Lewis, secretary of highways; Samuel Eckles, chief engineer; Fred H. Mason, purchasing agent.

Rhode Island State Purchasing Department, Providence. George H. Haines, purchasing agent.

Rhode Island State Board of Public Works, Highway Department, Providence. Abram L. Atwood, chairman, board of public works; G. H. Henderson, chief engineer.

South Carolina State Highway Department, Columbia. Ben M. Sawyer, chief highway commissioner; Charles H. Moorefield, State highway engineer.

South Carolina State Joint Committee on Printing, Columbia. W. T. Walker, secretary.

South Dakota State Department of Finance, Division of Purchasing and Printing, Pierre. C. F. Schmidt, purchasing agent.

South Dakota State Highway Commission, Pierre. Warren E. Green, chairman of commission; J. H. Lake, State highway engineer.

Tennessee State Department of Purchasing, Nashville. A. L. La Bar, purchasing agent.

Tennessee State Department of Highways and Public Works, Nashville. Robert H. Baker, commissioner of highways; T. C. McEwen, chief engineer.

Texas State Board of Control, Division of Purchasing, Austin. Sumner M. Ramsey, secretary.

Texas State Highway Commission, Austin. W. R. Ely, chairman; Gibb Gilchrist, State highway engineer.

Utah State Board of Supplies and Purchase, Salt Lake City. E. R. Miles, purchasing agent.

Utah State Road Commission, Salt Lake City. Henry H. Blood, chairman; H. S. Kerr, chief engineer.

Vermont State Department of Purchasing, Montpelier, J. C. Wallace, purchasing agent.

Vermont State Highway Department, Montpelier. George Z. Thompson, chairman.

Virginia State Department of Highways, Richmond. Henry G. Shirley, State highway commissioner; C. S. Mullen, chief engineer; E. F. Appel, purchasing agent.

Virginia State Purchasing Commission, Richmond. Charles A. Osborne, purchasing agent.

Washington State Department of Business Control, Division of Purchasing, Olympia. H. C. Van Eaton, supervisor of purchasing.

Washington State Highway Department, Olympia. Roland H. Hartley, chairman of commission; Samuel J. Humes, director of highways.

West Virginia State Board of Control, Purchasing Department, Charleston. John A. Wade, purchasing agent.

West Virginia State Road Commission, Charleston. C. P. Fortney, chairman.

Wisconsin State Bureau of Purchases, Madison. F. X. Ritger, purchasing agent.

Wisconsin State Highway Commission, Madison. Jerry Donohue, chairman; Walter C. Buetow, State highway engineer.

Wyoming State Board of Supplies, Cheyenne. Vincent Carter, chairman.

Wyoming State Highway Department, Cheyenne. S. W. Conwell, chairman of commission; Z. E. Sevison, State highway engineer.

VIII. GENERAL STANDARDIZING AGENCIES (U. S. A.)

Outlines of the standardization activities of four American organizations created for the sole purpose of carrying on the work of standardization, or work directly relating thereto, are given in the present chapter, with special reference to their accomplishments during the past year. The functions of these organizations are fairly well indicated by their titles, namely, American Standards Association, American Marine Standards Committee, American Society for Testing Materials, and the Central Committee on Lumber Standards. These four agencies are actively engaged in the formulation of standards, specifications, codes and methods of tests, and they cooperate with many technical trade associations, and governmental bodies. Additional information concerning the procedure of their committees engaged in formulating specifications and standards can be found in the 1927, 1928, 1929, 1930, and 1931 issues of the STANDARDS YEARBOOK.

Outlines of the work in standardization of the agencies of the Federal Government, including the Bureau of Standards, are to be found in Chapters V and VI of the present book; in Chapter VII the standardization work of State, county, and municipal agencies is presented briefly. Outlines of the standardization activities of many technical societies, trade associations, and organized-consumer groups are given in Chapter IX.

AMERICAN STANDARDS ASSOCIATION

The American Standards Association (ASA) is the recognized medium through which American industry functions in setting up for itself nationally acceptable standards. In essence it is a federation of 45 national technical societies, trade associations, and Federal Government departments, and it brings together all those directly concerned with a project, to study a problem, to formulate a workable and acceptable standard, and submit it for approval to an authorized committee, so that when this committee (made up of individuals officially appointed by the organizations concerned with the subject) has given its approval, there is assurance that the standard represents a real national opinion and may be considered an "American Standard" in the broadest sense.

At present more than 2,500 officially accredited representatives from every branch of industry, representing approximately 600 national organizations, are participating actively in the association's work. In December, 1930, the United States Government Printing Office became one of the member bodies of the ASA.

The administration of ASA affairs is vested in a board of directors of nationally known industrial executives. The final approval of standards rests with the Standards Council, which is made up of representatives of all 45 member bodies, all of which are

organizations or groups of organizations having an important interest in standardization. The council, therefore, acts as a court of review in which the work of technical committees is either accepted or rejected with reasons. The approval of a standard by the ASA means that everyone concerned has had an opportunity to participate in the work, that the work has been carried out under a procedure that has been regular, open, and above board, and that the standard represents a real national agreement on what is best in American engineering and industrial practice at the time of approval.

The association's offices are at 29 West Thirty-ninth Street, New York, N. Y. Dr. P. G. Agnew is the secretary, and a technical staff, including engineers who have had practical experience, assists in carrying on the work. The actual setting up of standards is done by technical committees representing the producing, distributing, and consuming groups concerned with the projects. It is a basic requirement of ASA procedure that no standards shall be approved unless all important interests have been represented in developing them, thus avoiding the domination of any one interest except when the consent of other groups has been granted.

The productive, initiating power of the ASA lies largely in the work of the technical committees, and a brief review of the procedure which must be followed will indicate why their recommendations may be rightfully considered as a real national agreement. Any responsible group may request the initiation of a standardization project. The request is usually accompanied by a statement setting forth the desirability of the particular project and the benefits that would accrue from national approval of a standard on the subject. The ASA then calls a general conference of all interests concerned with the subject in hand to decide whether or not the work shall be launched and what method is to be followed. In the majority of cases a "sectional committee" is charged with the task of making a study and presenting a final recommendation on the subject. Sometimes the committee may set about its work autonomously, or it may function under the support and guidance of one or more of the organizations chiefly concerned (officially called the "sponsor"). Any organization having an interest in the project has a right to appoint representatives on the committee, and it is one of the important functions of the ASA to see that all groups having an interest in a project are invited to appoint representatives on the technical committee. It is not unusual for conflicting interests to clarify their differences in committee discussions and to arrive at a practical compromise in making progress possible. Before a project developed by a committee can become an approved American Standard, the great preponderance of committee opinion must first be favorable.

In addition to the sectional committee method, which is most commonly followed, the association procedure includes three other methods: Existing standard method, proprietary method, and general acceptance method. Under the first of these three, provision is made for the approval of existing standards when it has been shown by proper exhibits of the submitting body that the standard represents a true consensus of competent industrial opinion with re-

spect to its suitability for national adoption. Proprietary standards, or standards developed and sponsored by a body having an outstanding and controlling interest and importance in the field of the standard, may be approved by the ASA when it is shown that the standard has the unanimous agreement of those who are concerned with its development and use. The general acceptance method is especially applicable in simple cases not requiring protracted technical consideration. The procedure which applies here requires that a conference be called of those primarily concerned—producers, consumers, and other competent interests—and if the decision of the conference is authenticated and supported by a sufficiently large number of written acceptances of the conference's recommendation from those who are concerned with the scope and provisions of the recommendation, then this is considered sufficient for approval as an American Standard.

Nationally acceptable standards have been prepared under the auspices of the ASA in practically every major field of industrial activity or are now under way. In addition to providing a suitable medium for the establishment of nationally acceptable standards, the ASA serves as a clearing house for information on standardization work both in the United States and abroad. It also acts as the authoritative channel in international cooperation in standardization activities.

Since the latter part of 1929 the ASA has been a member of the International Standards Association (ISA), the organization through which cooperation in the development of international industrial standards is secured. The ISA has its headquarters at Basel, Switzerland, and its membership includes 18 national standardizing bodies. The ASA is in close touch with standardizing work in foreign countries, and information concerning new projects, draft standards, and new standards is constantly being exchanged. Each of the standardizing bodies in 20 foreign countries maintains a file of the approved standards of all countries, and each acts as a sales agent for all the others, thus making these standards readily available to industry everywhere.

Every year the ASA handles a large number of requests for technical information on standardization. In answering these requests the office not only makes available the material in its files, but also collects information from numerous trade and technical organizations in the United States and abroad.

The monthly ASA bulletin, available primarily to sustaining members, reviews all important developments in the field of standardization and carries abstracts of articles on this subject appearing in foreign and American publications. Attention is called to important books or pamphlets pertaining to one or another aspect of the work, most of which are available to sustaining members. It also includes a section on standardization within companies, which gives detailed information of considerable value showing how individual companies have organized and developed their standards departments.

Up to September 1, 1931, 199 standardization projects have been approved by the American Standards Association. There are 167

additional uncompleted projects that have an official status before the ASA.

The following is a list of the standards approved by the American Standards Association from September 1, 1930, to September 1, 1931:

Civil engineering.—Portland cement; methods of testing cement; elevator safety code.

Mechanical engineering.—Cast-iron pipe flanges and flanged fittings for maximum working-steam pressure of 25 pounds; mechanical-refrigeration code; woodruff keys, key slots and cutters; track bolts and nuts.

Electrical engineering.—National electrical code; dry cells and batteries; insulator tests.

Ferrous metallurgy.—Zinc-coated (galvanized) sheets; zinc coatings on structural-steel shapes, plates and bars and their products; refined wrought-iron bars; wrought-iron plates.

Chemical industry.—Methods of routine analysis of white pigments; methods of laboratory sampling and analysis of coal and coke.

Textile industry.—Cotton rubber-lined fire hose; general methods of testing woven textile fabrics.

Wood industry.—Ultimate fiber stresses of wood poles; specifications for northern white-cedar poles; dimensions of northern white-cedar poles; specifications for western red-cedar poles; dimensions of western red-cedar poles; specifications for chestnut poles; dimensions of chestnut poles; specifications for southern pine poles; dimensions of southern pine poles.

Mining.—Coal-mine transportation code; fire-fighting equipment in metal mines.

Miscellaneous.—Symbols for heat and thermodynamics; methods of test for viscosity of petroleum products and lubricants; method of test for cloud and pour points of petroleum products; method of test for water and sediment in petroleum products, by means of centrifuge; method of test for water in petroleum products and other bituminous materials; method of test for distillation of gasoline, naphtha, kerosene, and similar petroleum products; method of test for distillation of natural-gas gasoline; burning quality of kerosene oils; burning quality of mineral seal oil; burning quality of long-time burning oil for railway use; detection of free sulphur and corrosive sulphur compounds in gasoline; melting point of petroleum; determination of autogenous ignition temperatures; installation of pulverized fuel-systems code; prevention of dust explosions in coal pneumatic-cleaning plants; and dimensional standards for motion-picture apparatus.

New projects given an official status by or proposed to the American Standards Association from September 1, 1930, to September 1, 1931, include:

Civil engineering.—Builders' template hardware; steel reinforcing bars; sizes of removable and permanent forms, pans, or domes made of wood, steel, or other material used in concrete-ribbed floor construction.

Mechanical engineering.—Shafting and stock keys.

Electrical engineering.—Recommendations for the operation of transformers; constant current transformers of the moving coil type; standard for capacitors; standard 60-cycle test voltage for bushings for transformers; transformers, induction regulators and reactors.

Mining.—Prepared bituminous coal.

Miscellaneous.—Safety code for the prevention of dust explosions in wood flour-manufacturing establishments; code for the prevention of dust ignitions in spice-grinding plants; code for the use of inert gas for fire and explosion prevention; sieves for testing purposes.

AMERICAN MARINE STANDARDS COMMITTEE

The American Marine Standards Committee (AMSC) was formed to promote simplification of practice and elimination of waste in the marine field by promulgating standard designs and specifications, and minimizing varieties of materials, fittings, and supplies for the

construction and operation of ships and port facilities. It consists primarily of a membership of nation-wide scope which comprises shipyards, ship repair and docking establishments, shipowners and operators, naval architects, marine engineers, manufacturers of marine appliances, materials, and supplies, also educational, commercial, and Government interests related to the marine industry. Its activities are controlled by an executive board elected annually from and by the membership. As of July 1, 1931, the membership comprised about 370 member bodies, widely distributed geographically.

Standardization projects are generally initiated by the executive board. Proposed standards are as a rule based upon current practice. One of the principal aims, however, is to correlate diversified designs and specifications in vogue, and by the criticisms and suggestions elicited during development of the standards to lead to improved or simplified results.

The technical work is developed under the direction of technical and special committees. There are standing technical committees on hull, engineering (machinery), ship operation, and port facilities. These committees are assisted as necessity occurs by subject committees formed to develop projects in their early stages. By mutual understanding with the American Association of Port Authorities, standards for port facilities are issued by the AMSC for both organizations. Coordination with the work of other national standardizing bodies is effected through representatives of the AMSC in committees of the American Standards Association, and by the appointment of representatives of the following organizations as advisory members of the executive board of the AMSC: American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, National Fire Protection Association, and the Bureau of Standards.

There are standing special committees to decide questions which may arise among the users of the marine standards and to review and submit recommendations on proposals for international marine standards.

One of the functions of the committee is to review its standards from time to time and to revise them if and when deemed advisable in order to keep pace with industrial progress and service requirements. So far two standards have been revised, and one has been canceled.

The findings of the committee are issued by the United States Department of Commerce in uniform publications designated as the AMSC series. These publications are sold at nominal prices by the Superintendent of Documents, Government Printing Office. Up to June 30, 1931, 75 of these publications had been issued, comprising 63 hull standards, 33 engineering (machinery) standards, 27 ship-operation standards, and 1 special standard. A detailed index to that group of publications had also been published. Since July 1, 1931, two more publications have been issued, one comprising standard designs of cleats for ships and the other standard designs of bollards and cleats for docks. The committee had promulgated 133 standards up to July 1, 1931.

The committee's current and prospective activities include proposed standards for hinged and fixed lights, rolled-steel shapes for shipbuilding, pipe flanges and flanged-pipe fittings, platform cargo slings, structural steel for ships, oil-tight hatch covers, hinges and other hardware for ships, ladders and gratings, hinged water-tight doors, fire-hose couplings and spanner, reinforced concrete piles for wharves and piers, structural-steel cargo masts for docks, and numerous other subjects.

As a measure of Government cooperation with the marine industry, the administrative office of the committee, which is also the clearing house and correlating center for the technical activities, is maintained in the Department of Commerce, Washington, D. C.; A. V. Bouillon is the secretary.

AMERICAN SOCIETY FOR TESTING MATERIALS

The work of the American Society for Testing Materials (ASTM), a national technical society, involves the promotion of the knowledge of materials of engineering and the standardization of specifications and methods of testing. This is carried out through the activities of 55 technical committees having a combined membership of about 2,400, appointed to study the properties of the many engineering materials and to develop standards covering these. The work is done in two ways: First, the reporting of scientific and technical data to the society by its committees in the form of reports, papers, and discussions that are published annually in the proceedings and, second, in the activties of the committees appointed to develop and study new information on the properties of materials.

The committees function under definite regulations, governing the personnel and method of procedure. Each committee is made up of three main classes of membership—producers, consumers, and general interests. This latter class comprises independent authorities who have expert knowledge of the materials to be studied, but who are not concerned directly with either their production or use. Under the committee rules, the " producer " group may not predominate in any committee. By this procedure the producers and consumers of material are brought together on an equal footing, and the results of the work are thus satisfactory to both. The committees, then, are responsible to the society for the development of standard specifications and methods of testing. This is a most important function.

Membership in the society is held by individuals; companies; firms; corporations; industrial and trade associations; testing laboratories; Federal, State, and municipal departments; universities and technical schools; and technical societies and libraries. The total membership is about 4,400. Society headquarters are at 1315 Spruce Street, Philadelphia, Pa. C. L. Warwick is the secretary-treasurer.

Reports of the progress in the many activities sponsored by the society are made at each annual meeting in June. Each committee submits a report for the year at this time. In addition to the annual meeting, the society holds a group meeting of committees each year, usually in the spring. These meetings extend over a period of several days and enable members who are on more than one committee to concentrate their activities. Recently at the requests of society mem-

bers who are located in industrial centers and regions where the membership is large, regional meetings have been held in conjunction with the group meetings. The regional meetings consist usually of two technical sessions at which an outstanding engineering-materials subject is discussed by leading authorities. Local meetings of society members are held at various intervals, and, in addition, it is customary for each committee to meet about twice a year.

Contributions in the form of technical papers and discussions by leading investigators in scientific and technologic fields, including many important contributions from industrial researches, are presented before the society at the various meetings mentioned above, chiefly at the annual and regional meetings. The following outstanding topics have been discussed at recent ASTM meetings: The limitations of the present knowledge of materials for engineering application, covered in three phases—nonferrous metals, materials in the electrical industry, and reinforced concrete; general discussion of welding and the testing of welds and welded products, this being treated in an extensive symposium; abrasion testing of rubber; weathering characteristics of masonry materials; and malleable-iron castings, each treated fully in a symposium. A symposium on the effect of temperature on the properties of metals was held. This important subject was discussed in two parts—one dealing with engineering trends and requirements for metals at high and low temperatures; the other with properties of available metals for high-and-low-temperature service. In addition, there were presented papers covering the following subjects: Corrosion and fatigue studies of metals; damping capacity of materials; modern paving emulsions; physical properties of hardened tool steels; shear tests of cast iron; relation between magnetic properties, impact strength, and hardness of steel; fatigue properties of brass; shear fatigue tests of nonferrous metals; hiding power of paints; resistance of fire-clay brick to thermal spalling; hollow-masonry building units and the stability and fire resistance of walls made from these; temperatures in mass concrete; accelerated freezing and thawing test for concrete aggregates; and many papers describing testing apparatus and methods.

In addition to these technical subjects, "the economic significance of specifications" was discussed, and papers dealing with different phases of this important subject were read at a session of the 1931 annual meeting. An exhibit of testing apparatus and machines was sponsored by the society in which the Bureau of Standards and other outstanding research laboratories took part, as well as leading manufacturers of testing equipment.

In accordance with the policy of the society to expand its research and standardization activities to cover important engineering materials a new standing committee on mortars for unit masonry has been organized, and committees on water analysis, and on paper and paper testing were authorized, and organization work has been started.

The development of standards covering the following engineering materials may be cited as among the current activities of the society which are of outstanding importance: Various types of fabricated steel pipe; steel plates of firebox quality for forge welding; copper-base alloys; alloy-steel locomotive forgings; alloy-steel bolting ma-

terial; structural steel for ships; high-test gray-iron castings; ferromolybdenum; electrical-heating and electrical-resistance alloys; alloy die castings; silver solders; aluminum and magnesium alloys; gypsum board and lath; structural clay tile; insulating oils; curing of concrete, fine and coarse aggregates; concrete masonry units; paint solvents, pigments and enamels; petroleum products; electrical insulating materials; rubber pump valves; fire-hose; textile materials, including cotton goods for coating, cotton tape, and rayon; coal, natural building stone, and slate.

In the following table are shown the number of standards and tentative standards adopted in the year 1931 and the total number adopted to date, the standards being classified in accordance with the five main heads under which the society's standardization activities are conducted:

	Accepted in 1931			Total adopted to date	
	Standards	Tentative revisions of standards	Tentative standards	Standards	Tentative standards
A. Ferrous metals	3	11	7	104	21
B. Nonferrous metals	4	----------	6	70	15
C. Cement, lime, gypsum, concrete, and clay products	10	5	13	62	28
D. Miscellaneous mtrls	15	6	12	197	109
E. Miscellaneous subjects	----------	----------	2	10	7
Total	32	22	40	443	180

The society adopted the following standards and tentative standards in 1931:

A. *Ferrous metals.*—Standard specifications for alloy-steel bolting material for high-temperature service; welded wrought-iron pipe; high-test gray-iron castings.

Tentative specifications for structural steel for ships; steel plates of flange and fire-box qualities for forge welding; heat-treated-carbon-steel helical springs; carbon-steel forgings for locomotives; normalized and tempered alloy-steel forgings for locomotives; electric-fusion-welded steel pipe; electric-resistance-welded steel pipe; forge-welded steel pipe; lock-bar steel pipe; riveted steel and wrought-iron pipe; ferromolybdenum.

Tentative definitions of terms, with units and symbols to magnetic testing.

B. *Nonferrous metals.*—Standard specifications for aluminum-alloy (duralumin) sheet; aluminum-manganese alloy sheet; aluminum-base sand-casting alloys in ingot form; aluminum-base alloy sand castings.

Tentative specifications for magnesium-base alloy castings; copper-base alloys in ingot form for sand castings; drawn or rolled 80 per cent nickel, 20 per cent chromium alloy for electrical-heating elements; drawn or rolled alloy, 60 per cent nickel, 15 per cent chromium, balance iron, for electrical heating elements; aluminum-base alloy die castings; zinc-base alloy die castings.

Tentative methods of chemical analysis of silver solders; test for determining the temperature-resistance constants of resistance alloys.

C. *Lime, concrete, and clay products.*—Standard specifications for hydrated lime for structural purposes; specifications and tests for structural clay load-bearing wall tile; and for structural-clay fireproofing, partition, and furring tile; and for structural-clay floor tile.

Standard methods of making and storing compression test specimens of concrete in the field; securing specimens of hardened concrete from the structure; testing brick (compression, flexure, absorption); test for softening point of fire-clay brick.

Standard definitions of terms relating to refractories; and terms relating to structural clay tile.

Tentative specifications for sand for use in lime plaster; gypsum wall board; gypsum lath; gypsum sheathing board; concrete aggregates; curing Portland-cement concrete; curing Portland-cement concrete slabs with bituminous coverings; curing Portland-cement concrete slabs with calcium chloride admixture; curing Portland-cement concrete slabs by surface application of calcium chloride; curing Portland-cement concrete slabs with wet coverings; concrete masonry units.

Tentative method of routine-analysis of the cement content of hardened Portland-cement concrete; test for apparent specific gravity of coarse aggregates in a saturated condition; test for structural strength of fine aggregate using constant water-cement-ratio mortar; methods of test for soundness of fine aggregates by use of sodium sulphate; soundness of coarse aggregates by use of sodium sulphate; control test for resistance of fire-clay brick to thermal spalling action.

Tentative definition of terms relating to the gypsum industry and terms relating to heat transmission of refractories.

D. *Miscellaneous materials.*—Standard specifications for basic carbonate white lead; red lead; aluminum powder for paints (aluminum-bronze powder); gold-bronze powder; toxic ingredients in antifouling paints.

Standard methods of test for alkalinity or acidity of pigments; bleeding of pigments; hygroscopic moisture (and other matter volatile under the test conditions) in pigments; oil absorption of pigments; routine determination of acetone extract in dry lampblack and dry bone black; determination of polishing lubricant in aluminum powder for paints (aluminum-bronze powder); size of anthracite; water absorption of slate; flexure testing of slate (modulus of rupture, modulus of elasticity); and testing electrical insulating oils.

Tentative specifications and tests for soluble nitrocellulose; acetone; specifications for cotton rubber-lined fire hose for public and private fire department use; steam hose; insulated wire and cable; 30 per cent heavea rubber; rubber pump valves; tolerances and test methods for rayon; cotton goods for rubber and pyroxylin coating; 0.007-inch cotton tape; enameling duck for the tire industry; tolerances and test methods for silk and cotton tapes; for asbestos tape for electrical purposes; and specifications for chafer tire fabrics.

Tentative method of test for tinting strength of white pigments; of sampling and testing lacquer solvents and diluents; of testing nitrocellulose clear lacquers and lacquer enamels; for vapor pressure of natural gasoline (Reid method); testing asphalt roll roofing surfaced with fine talc, granular talc, or mineral granules, likewise asphalt shingles surfaced with mineral granules; method of flexure testing of natural building stone; test for absorption and apparent specific gravity of natural building stone; modulus of elasticity of natural building stone; shear testing of natural building stone; of testing varnishes used for electrical insulation; testing sheet and tape insulating materials for dielectric strength; testing electrical insulating materials for power factor and dielectric constant at frequencies of 100 to 1,500 kilocycles; testing laminated sheet materials used in electrical insulation; test for comparing the thermal conductivities of solid electrical insulating materials; chemical analysis of rubber products; test for hardness of rubber; methods of determining relative humidity; and for identification of textile fibers and their quantitative determination in mixed goods. Tentative definitions of terms relating to natural building stone.

E. *Miscellaneous subjects.*—Tentative specifications for round-hole screens for testing purposes. Tentative method of bend testing for ductility of metals.

Cooperation with American Standards Association and Other National Organizations.—As one of the five technical societies which united in the founding of the American Standards Association, the American Society for Testing Materials has been especially active in the work of the American Standards Association, to which it has submitted many of its standards for approval. It is sponsor or joint sponsor for 48 standardization projects or sectional committees, and 58 of its standards have been approved and 9 are under consideration for approval by the American Standards Association.

In addition to this cooperative work, it is the policy of the society to cooperate with several other organizations, either in standardization work or in research activities, wherever a common interest exists. Hence the society has joined with other national bodies in a number of cooperative movements, which have usually taken the form of joint committees or councils. Among others, the following are mentioned upon which the society is represented: Division of Engineering and Industrial Research of the National Research Council, American Bureau of Welding, Joint Committee on Investigation of the Effect of Phosphorus and Sulpher in Steel, Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, Joint Committee on Concrete Culvert Pipe, and Conference Committee with ASME Boiler Code Committee.

Certain branches of the Government cooperate with the various standing committees of the society with which their work is closely allied. The Bureau of Mines, Bureau of Public Roads, Bureau of Standards, Forest Products Laboratory, and others have done a great deal of work of valuable assistance in the development of many society standards.

Marking of A. S. T. M. Apparatus.—In a number of instances where committees of the society have developed specifications for testing apparatus, requirements have been included that the apparatus be marked in a manner identifying it with the society's standard. The Scientific Apparatus Makers of America recommended that in such cases it should also be required that the name or trade-mark of the manufacturers of such apparatus be marked thereon as a means of identifying the origin of the apparatus and placing the name of the manufacturer back of the statement implied by the appearance of the "ASTM" mark that the apparatus conforms to the society's standards. The executive committee of the society referred this proposal to the committee on standards, and upon its recommendation the executive committee, at the annual meeting of the society in June, 1931, announced that it had adopted the following resolutions:

Resolved, That where the specifications of the society require that apparatus be marked in some way with the initials "ASTM" it also be required that the name or trade-mark of the manufacturer be marked on the apparatus, with the understanding that this requirement need not apply where apparatus specified by the society is not required to be marked as "ASTM" apparatus;

Further resolved, That the attention of standing committees be called to the desirability, where requirements for apparatus are specified, of specifying that such apparatus be marked to identify it as ASTM apparatus, including the manufacturer's name or trade-mark.

Means of Encouraging and Facilitating the Use of Standards.—For ease of reference the standards of the society are published in both separate form and collectively in a book of ASTM standards, issued triennially, with supplements in intervening years, and a book of ASTM tentative standards, issued annually. In this way the standards reach many of those who are principally interested in the use of specifications, methods of testing, and definitions of engineering materials. The bound publications are furnished with complete subject indexes, and the standards are listed under the headings of the materials covered and also by serial designation. In addition, the society issues an annual index to ASTM standards and tentative standards, which is a compilation, under appropriate key words of

titles of all ASTM standards and tentative standards, together with the page and volume references of the society publications in which they appear.

Special pamphlets containing the standards applying to a specific field are given widespread distribution. During the past year pamphlets on petroleum products and lubricants, electrical insulating materials, and textile materials have been published and a book containing selected ASTM standards for engineering students has been adopted by many technical schools as one of the required textbooks. An idea of the distribution of ASTM standards can be gained from the fact that 8,000 copies of the 1930 Book of ASTM Standards were printed, and 2,150 copies of the 1931 Book of ASTM Tentative Standards. In addition, it is not unusual for the society to distribute annually upwards of 50,000 reprints of the separate standards.

Permission to reprint any of the standards of the society being readily given by the executive committee of the society, the standards have been reprinted in full in many handbooks, purchasing catalogues, etc. A number of specifications have received widespread distribution by a special reprinting which sometimes totals many thousands of copies.

Many of the specifications of the society have been incorporated in general codes, such as the boiler code of the American Society of Mechanical Engineers, the building code recommended by the National Board of Fire Underwriters, the United States Department of Commerce, and in the building codes of many of the municipalities of the country, and the codes prepared by various Building Officials' Conferences.

A committee has been giving consideration to the possibility of using American Society for Testing Materials' standards in connection with quotations given in trade papers in the belief that these standards can serve a very useful purpose as the basis of quotations and bring specifications into play at the very inception of commercial transactions.

CENTRAL COMMITTEE ON LUMBER STANDARDS

The Central Committee on Lumber Standards consists of 11 representatives of lumber manufacturers, wholesalers, retailers, and consumers. Its headquarters are in the Transportation Building, Washington, D. C. Arthur T. Upson is the secretary. Associated with the central committee are the Consulting Committee on Lumber Standards and the Hardwood Consulting Committee, both acting in an advisory capacity.

In cooperation with the United States Departments of Agriculture and Commerce, this committee makes recommendations for the simplification of sizes, grades, nomenclature, and trade practices in the lumber industry. The committee's findings are recognized as "American lumber standards" and published by the division of simplified practice of the Bureau of Standards.

Thus far there have been published, in Simplified Practice Recommendation No. 16, lumber size and use classifications; nomenclature of commercial softwoods; definitions of defects and blemishes; lumber abbreviations; basis for measurement of lumber sizes; season-

ing standards; basic grade names and qualities; rough and finished sizes; lengths and general provisions covering the description, measurement, tally, shipping, and inspection of both yard lumber, and factory and shop lumber; basic provisions for selection and inspection of softwood dimension and timbers where working stresses are required; standard designs and universal sizes of moldings; uniform patterns for worked lumber; standards for red-cedar shingles; and provisions for certification of quality and manufacture through grade marking and car tally cards.

The central committee has also approved recommended American Standards for nomenclature for domestic hardwoods and certain basic grading provisions for hardwood lumber, formulated largely by the National Hardwood Inspection Rules Committee. In their work they were assisted by the Hardwood Manufacturers Institute, the National Lumber Manufacturers Association, the Central Committee on Lumber Standards, the Forest Products Laboratory of the United States Forest Service, and by the Department of Commerce.

The central committee has completed the formulation of softwood standards. The latest revision of the American lumber standards was published by the division of simplified practice, December, 1929, in Simplified Practice Recommendation R16–29, fourth edition. The principal accomplishments of the past year were the formulation of minor revisions, mostly in the basic provisions on structural timbers, to be recommended to the next General Lumber Conference at the Department of Commerce, when held; and of greater importance the revision of the 7,000 series of American standard moldings in accordance with practical manufacture and good architecture.

Future work includes the consideration of technical questions arising in connection with the softwood standards; further work on hardwood standardization; publication and circulation to the trade of the revised American standard series of moldings; and, what is one of the most important phases of the standardization program, stimulation of all branches of the industry to put into actual practice the principles set forth in the softwood standards, including the certification of lumber manufacture and qualities. This is being accomplished by the publication and distribution of Simplified Practice Recommendation No. R16–29, through the lumber trade press, by correspondence, and through the associations and organizations representing the various branches of the industry.

IX. STANDARDIZING ACTIVITIES OF TECHNICAL SOCIETIES AND TRADE ASSOCIATIONS

The accompanying sketches of the activities of trade associations, scientific and technical societies, and other agencies, attempt to present in condensed form a picture of the standardization movement in the various lines of industry conducted by these organizations. In these outlines, 416 in number, particular attention has been paid to current standardization programs and to accomplishments to date, with special reference to the year just past, without reproducing information concerning the organization and procedure of the work of standardization, which may be found in previous editions of the Standards Yearbook.

STANDARDIZING AGENCIES ALPHABETICALLY ARRANGED

Abrasive Paper and Cloth Manufacturers Exchange, R. P. Carlton, chairman of standardization committee, care of Minnesota Mining & Manufacturing Co., 797 Forest Street, St. Paul, Minn. Revised standard specifications for glue bond abrasive-coated products were adopted by this organization in 1929. The standardization committee for waterproof sandpaper has defined fine flour grades through the adoption of what is known as the sedimentation method of analysis. This method has given a means of checking fine sands (finer than screen grades), which previously were not subject to accurate laboratory control. This association initiated the movement which resulted in the establishment and acceptance by the producing and consuming industry of standard sizes and grades for the abrasive products enumerated above, as promulgated in a simplified practice recommendation issued by the Bureau of Standards.

Aeronautical Chamber of Commerce of America (Inc.), Luther K. Bell, secretary, 10 East Fortieth Street, New York, N. Y. Several committees of this organization are actively engaged in developing standards and uniform procedure for the aviation industry. In cooperation with the American Petroleum Institute, the executive committee of the fuels and lubricants section of the chamber developed a safety code relating to standard safety rules in connection with the proper handling of gasoline for the purpose of eliminating many sources of fire and accidents. This code has been adopted by the industry. The export committee is still carrying on work relative to the compilation of a standard aviation cable code. In order to set up permanent machinery for the development of good practice codes for the aviation industry, the executive committee of the chamber has authorized the formation of a safety conference to be composed of one representative from each of the aircraft manufacturing and operating members. In this way the best safety practices can be constantly developed within the industry itself and for the best interests of aviation. The chamber cooperates very closely with the Society of Automotive Engineers in parts for aircraft construction. It the standardization of materials and is officially represented on the A. S. A. sectional committee on aeronautic safety code.

Agricultural Insecticide and Fungicide Manufacturers' Association, George B. Heckel, secretary, 1002 Public Ledger Building, Philadelphia, Pa. This association sponsored the simplified practice recommendation for package sizes for insecticides and fungicides, recently reaffirmed by the industry. Its standards for the metallic copper content of commercial Bordeaux mixture and for lime-sulphur solution have received general acceptance.

Amateur Athletic Union of the United States, Daniel J. Ferris, secretary, 233 Broadway, New York, N. Y. Among the objects of this organization are the establishment and maintenance throughout the United States of a uniform test of amateur standing, and uniform rules for the government of all athletic sports within its jurisdiction; the institution, regulation, and awarding of the amateur athletic championships of the United States; and the institution of a bureau of records covering all branches of amateur sport in the United States. This union recognizes all amateur sports and claims jurisdiction over basket ball, boxing, gymnastics, handball; running, including hurdle, obstacle racing, and steeplechasing; walking, jumping, and pole vaulting; putting shot and throwing hammer, weights, javelin, and discus; swimming, tug-of-war, catch-as-catch-can wrestling, Greco-Roman wrestling, weight lifting, volley ball, indoor baseball, squash ball, code ball, field handball, bobsleighing and coasting, and ice hockey. The establishment and definition of rules for the government of athletic sports are included in the duties of a board of governors which is elected each year and is representative of the active and allied member associations of the union. Besides the adoption of standard contest rules for the various sports under its jurisdiction, the union also fixes standards on dimensions, weights, material, and shapes of the various implements, balls, etc., entering into athletic contests.

American Association for the Advancement of Science, Burton E. Livingston, general secretary, Charles F. Roos, permanent secretary, Smithsonian Institution Building, Washington, D. C. This association is cooperating with other organizations, under the procedure of the American Standards Association, in the preparation of standard definitions of electrical terms. It is also acting as joint sponsor under the same procedure for the standardization of scientific and engineering symbols and abbreviations. The latter activity has already resulted in the American standard symbols for photometry and illumination, mathematical symbols, and letter symbols for electrical quantities, and in tentative American standards for symbols for hydraulics, heat, and thermodynamics, aeronautical symbols, and graphical symbols for telephone and telegraph use, and navigational and topographical symbols.

American Association of Cereal Chemists, M. D. Mize, secretary-treasurer, 833 Omaha Grain Exchange, Omaha, Nebr. Standardization has been carried on by this association in the field of chemical methods used by cereal chemists. The results of such work are contained in the publication "Methods of Analysis of Cereals and Cereal Products," which is at present undergoing revision. Other standards are being prepared by committees on laboratory baking and methods of testing cake and biscuit flours. In September, 1930, a fellowship was established at the University of Nebraska, for the purpose of developing and perfecting a standard laboratory baking procedure. This fellowship was continued during the year 1931.

American Association of Medical Milk Commissions (Inc.), Harris Moak, secretary, 360 Park Place, Brooklyn, N. Y. The association has adopted and promulgated a pamphlet, "Methods and Standards for the Production of Certified Milk," containing regulations on the organization of local medical milk commissions, dairy buildings and equipment, herd management and stable practice, veterinary supervision, milking, handling and transportation of milk, and hygiene of employees, as well as specifications for certified milk. Any dairyman who agrees to undertake the production of milk meeting its standards is permitted by the association to use its seals, bearing the term "certified milk," on milk bottles. Continued use of these seals is based on weekly examination and inspection of sample milk by local medical milk commissions.

American Association of Nurserymen, Charles Sizemore, secretary, Louisiana, Mo. This association's horticultural standards, adopted in 1923, established standard rules and definitions for grading deciduous and evergreen trees and shrubs, vines, herbaceous perennials, and fruit trees. It adopted the Ridgeway color standards and nomenclature as its standard in color and word descriptions of nursery products. In 1930 new and revised grading standards for shrubs and rose bushes were adopted by this organization and by the Ornamental Growers Association. The standardization committee of the association is now working on a revised edition of its horticultural standards which will be completed early in 1932.

American Association of State Highway Officials, W. C. Markham, secretary, National Press Building, Wash-

ington, D. C. In 1931 this association issued a publication, "Tentative Standard Specifications for Highway Materials and Methods of Sampling and Testing," in which are incorporated the standards of the association relating to highway materials. Several of the above specifications and methods of test are identical with or modifications of the standard specifications of the American Society for Testing Materials. During the past year the association also issued in printed form its "Standard Specifications for Highway Bridges and Incidental Structures" covering construction and design of concrete, masonry, and steel highway bridges, and including specifications for structural, rivet, and eyebar steel, steel forgings and castings, wrought-iron, iron castings, phosphor bronze, masonry stone and brick, asphalt paving blocks, wood blocks, and tar-pitch filler. Many of the latter materials specifications are identical with ASTM specifications. The association has also prepared, though not yet published, tentative standard specifications for concrete pavements. The committee on standards is now working on standard specifications for swing bridges and bituminous pavement, the former of which will probably be completed during the current year. The surface treatment and bituminous macadam sections of the latter specification are also well advanced. Plans are going forward for revising the "Manual for the Manufacture, Display, and Erection of United States Standard Road Markers and Signs." This association cooperated with other bodies, under the procedure of the American Standards Association, on work which resulted in the recently revised American standard specifications for Portland cement; specifications for drain tile; and methods of testing bituminous road and paving materials. It is officially represented on the Joint Concrete Culvert Pipe Committee.

American Association of Textile Chemists and Colorists, Alex. Morrison, secretary, care of American Woolen Co., Andover, Mass. The association is actively cooperating with the British Society of Dyers and Colourists toward the establishment of international standard methods of dye testing. It maintains three research associates, two at the Bureau of Standards and one at the Lowell Textile Institute, for work on textiles and dyes. Through various subcommittees of its research committee, the association has prepared standard methods for making light fastness tests; methods for determining minute quantities of metals particularly copper and manganese in rubberized fabrics; methods for determining total sizing and finishing materials in cotton cloth; tests for waterproofed fabrics; methods of testing for fastness of dyed textiles to perspiration, acids and alkalies, carbonizing, and sea water; and means for the identification of the different classes of rayon. The subcommittee on color standardization has compiled a comprehensive bibliography on the whole subject of color measurements and standardization which will serve as a foundation for further study. For the laboratory duplication of the effects of commercial laundering and other industrial operations, there was devised a standard "launderometer." The association has approved standard methods for determining the fastness to washing, fulling, chlorine, stoving, degumming, dry and wet heat, etc., of dyestuffs on cotton, rayon, silk, and wool fibers. Four standards have been prepared, representing five grades of fastness to washing on silk. Work is going forward on the preparation of standard dyed samples representing the various classifications of fastness of dyeings on other fabrics both to light and washing. The association has brought up to date its tabulation of American dyes.

American Automobile Association Ernest N. Smith, executive vice president, Pennsylvania Avenue at Seventeenth Street NW., Washington, D. C. As a founder member and one of the financial backers of the National Conference on Street and Highway Safety, this organization is urging its 1,073 affiliated motor clubs to sponsor both the uniform vehicle code and the model municipal traffic ordinance. Through its National Committee on Highway Widening and Planning it is engaged in formulating standards designed to eliminate bottle necks and points of congestion on streets and highways. It has adopted a code for the promotion of safe driving and the removal of irresponsible drivers from the highways, and promulgated the model A. A. A. safety-responsibility bill for adoption by all States in lieu of compulsory automobile liability insurance. In 1928 a safety department was organized to sponsor safety educational activities which will tend to reduce automobile accidents and accident hazards, the publication of loose-leaf lessons and safety education for use in correlation with regular school

curricula, distribution of school safety posters, and the organization of schoolboy safety patrols for the guidance of school children in traffic. Standardization has been extended to every phase of this safety program. In cooperation with the Bureau of Standards it prepared and distributed pamphlets on brake testing and headlight testing, and charts for the standardization of headlight adjustments. It served as joint sponsor with the Bureau of Standards for the sectional committee on safety code for automobile brakes and brake testing, and is officially represented on the sectional committee for a code of street-traffic signs, signals, and markings.

Standardization has been a factor in the issuance of more than 5,000,000 maps and touring publications annually. The association operates a central publishing office for the benefit of its affiliated clubs in order that they may secure more conveniently and economically standard material and supplies with which to carry on their various activities. The contest board of the American Automobile Association, formed 28 years ago, sets the standards and formulates rules under which competitive automobile races are run; speed tests are sanctioned for international recognition; and automotive products are tested for an unbiased opinion as to their merit. It adopts the specifications for automobiles participating in championship races. Out of the stress and strain of these races have come many refinements and improvements to the automobile. Tests of automotive and allied products under standard rules have become one of the major functions of the contest board which offers a medium for the industry to have its wares certified to the car-owning public.

American Bakers Association, Tom Smith, secretary, 1135 Fullerton Avenue, Chicago, Ill. The scientific research and educational activities of this association are conducted by the American Institute of Baking. (See p. 304.)

American Bleached Shellac Manufacturers Association (Inc.), R. W. McClintock, secretary, 80 Cliff Street, New York, N. Y. In cooperation with the United States Shellac Importers Association, this organization has formulated standard methods of analysis and specifications for both bleached and orange shellac. It has adopted the standard methods of the American Society for Testing Materials for determinations of rosin, alcohol, insoluble impurities, wax in shellac, water-soluble extract in orange and white shellac, and moisture in shellac. The association has also adopted standard specifications for bleached shellac and standard methods for determining penalties on excess moisture in dried bleached shellac, and arsenic shellacs that contain small traces of this component.

American Boiler Manufacturers Association, A. C. Baker, secretary, 801 Rockefeller Building, Cleveland, Ohio. This association has adopted and makes use of the boiler code of the American Society of Mechanical Engineers. It is represented on A. S. A. sectional committees working on the standardization of bolt, nut, and rivet proportions and on the standardization of dimensions and material of wrought iron and wrought steel pipe and tubing.

American Bottlers of Carbonated Beverages, Junior Owens, secretary, 726 Bond Building, Washington, D. C. In order to eliminate many of the difficulties arising in connection with the use of various sizes of pipe lines, fittings, connections used in bottling equipment, bottles, boxes, etc., the association sponsored the organization of certain of its associate members, comprising manufacturers of machinery and supplies used by beverage manufacturers, into the Beverage Allied Industries Council, which deals with problems in standardization. The association's "Educational Bulletin No. 4" contains completed standards for bottle boxes, water supply lines for carbonators (pump inlets), carbonator-filler carbonated water connections, sirup line connections, straight pipe threads, tapered pipe threads, conveyor chains, crown finish for beverage bottles, and bottle-washing compound. Included also are recommended practices dealing with rubber hose and block tin tubing, compression couplings, carbonated water and sirup valves, gas volume tests, and beverage bottles, the latter prepared in cooperation with the division of simplified practice of the Bureau of Standards. The association has inaugurated a certification plan, through which it publishes, with certain of its standards, lists of manufacturers guaranteeing compliance with the requirements of the standards.

American Brush Manufacturers Association, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. In cooperation with other units of

the industry this association was instrumental in the establishment and acceptance of a reduced and limited number of standard sizes and varieties of paint and varnish brushes, floor sweeps, and block sizes for calcimine brushes, set forth in simplified practice recommendations issued by the Bureau of Standards.

American Bureau of Shipping, J. W. Cantillion, secretary, Stevenson Taylor Memorial Building, 24 Old Slip, New York, N. Y. A publication known as "Rules for Building and Classing Steel Vessels" in which are included the general requirements for the hull structure, machinery, and deck equipment for vessels, has been prepared by this bureau. The bureau works in close harmony with the American Marine Standards Committee in the development of standards for materials, fittings, equipment, and structural methods. It is officially represented on three A. S. A. sectional committees.

American Bureau of Welding, William Spraragen, secretary, division of engineering, National Research Council, 29 West Thirty-ninth Street, New York, N. Y. This bureau acts as an advisory board on welding of the American Welding Society and of the division of engineering and industrial research of the National Research Council. The work of the bureau is carried on by several committees engaged in various projects. The committee on standard tests for welds is working on proposed standard tests and is considering modifications of the tensile and bend tests specimens. The committee on welding wire specifications has conducted a survey to determine the changes to be made in existing specifications and on this basis has prepared revised specifications on welding wire which will be based upon the physical properties of the resultant welds rather than on the chemical analysis now in force. It is expected that in this way distinctions will be made in various grades of wire based upon the quality of welds produced by them. This will permit the inclusion of patented wires and covered electrodes. One of the most important activities of the bureau is that relating to fundamental research which is being conducted under the auspices of the committee on fundamental research. Studies on welded rail joints and structural steel have been practically completed by committees handling these projects. At the request of the Bureau of Standards, the American Bureau of Welding formulated procedural specifications for use in connection with the preparation of aircraft joints to be tested. The bureau is officially represented on the sectional committee on national safety code for the protection of the heads and eyes of industrial workers, which has been adopted as an American recommended practice under the procedure of the American Standards Association. Perhaps one of the most important reports of recent years published by the American Bureau of Welding is that of the structural steel welding committee. This report, which includes over 200 printed pages, is based upon the results of tests of several thousand specimens, fabricated in 39 shops and tested in 24 laboratories. It involves 55 types of joints in 169 sizes. These results showed a remarkable uniformity of welds made with qualified welders under recognized procedures.

American Ceramic Society, Ross C. Purdy, secretary, 2525 North High Street, Columbus, Ohio. Standards relating to various clays, ceramic whiting, limestone, lime, enamel, glass, sand, and other ceramic materials have been adopted by this association. It cooperated in the establishment of the commercial standard relating to grades of feldspar and in the formulation of the simplified practice recommendation for malleable foundry refractories. Work is now in progress on the development of standard definitions for all white wares, including china, porcelain, earthenware, and numerous related wares. European cooperation on the latter project is being sought. The society is now cooperating with other organizations, under the auspices of the American Standards Association, in the standardization of plumbing equipment, standard classification of coal, and standard scientific and engineering symbols and abbreviations.

American Chemical Society, Charles L. Parsons, secretary, Mills Building, Washington, D. C. The society's committee on analytical reagents has published more than 100 standards for chemical reagents, including 10 specifications proposed in 1931, covering magnesium oxide, mercuric chloride, mercurous chloride, sodium nitroferricyanide, uranium nitrate, lead chromate, lead nitrate, cadmium chloride, chromium trioxide, and perchloric acid, 60 per cent. In 1920 and 1921 this committee published Unit Weights for the Purchase of Reagents, a set of suggested standard weights for the

packaging of 164 laboratory chemicals. There is published twice yearly a list of manufacturers who have agreed to stock reagent chemicals in standard metric packages, and who receive estimates and make bids in the metric system, making no extra charge for the service. In 1927 the committee on standard apparatus published a report setting forth recommendations for items of certain types of apparatus to be kept in stock by dealers and in laboratory storerooms for ordinary laboratory work. During 1930 this committee cooperated with the Scientific Apparatus Makers of America and the office of the Surgeon General of the Army in this line of activity. The committee on soap and soap products cooperated in the preparation of the Federal specifications for soap. The society assisted in the formulation of the American Society for Testing Materials standard for coal sampling and analysis. It is represented on three A. S. A. sectional committees.

American College of Surgeons, 40 East Erie Street, Chicago, Ill. Franklin H. Martin, director general; Malcolm T. MacEachern, M. D., associate director and director of hospital activities; Bowman C. Crowell, M. D., associate director and director of clinical research. The standardization of hospitals, hospital organization, management and procedure, and clinical and physical standards are important features of the activities of this organization. The minimum standard for hospitals adopted by the college covers in particular the organization and duties of the medical staff, the providing of accurate and complete case records on all patients treated, and the furnishing of adequate diagnostic and therapeutic facilities. Names of hospitals of the United States and Canada conforming to the minimum standard of the college are published annually in a list of approved hospitals. This organization in 1930 issued a manual containing complete information regarding a standard classification and nomenclature for surgical dressings and proposed standard specifications for sponges, abdominal packs, sterile gauze dressings, and pads. During the past year the college prepared and adopted a minimum standard for the organization of clinics for the diagnosis and treatment of cancer, also a minimum standard for industrial medicine and traumatic surgery. It initiated and cooperated in the preparation of the proposed commercial standard for steel bone plates under the procedure of the division of trade standards of the Bureau of Standards.

American Concrete Institute, Harvey Whipple, secretary, New Center Building, Detroit, Mich. This organization has developed 12 standard and 10 tentative specifications for concrete and concrete work. It has adopted a proposed recommended practice for heavy-duty concrete floor finish and a tentative recommended practice for the treatment of exterior surfaces of industrial reinforced concrete buildings. During the past year consideration was given to a proposed revision of the tentative recommended practice for the manufacture of concrete building block, tile, and brick; tentative specifications were amended and adopted as tentative covering concrete work on ordinary buildings, concrete work on the small job, and supplying, fabricating and setting reinforcing steel on ordinary buildings; recommended practices were proposed for dusted-on concrete floor finish and the use of pigment admixtures in troweled concrete surfaces; tentative specifications for ready-mixed concrete were adopted, and specifications for concrete burial vaults were proposed through a committee report. This organization cooperated in the work of three A. S. A. sectional committees. It initiated the movement which resulted in the selection and acceptance by industry of a simplified recommendation for sizes of concrete blocks, concrete building tile, and concrete brick.

American Concrete Pipe Association, M. W. Loving, secretary, 33 West Grand Avenue, Chicago, Ill. The association has adopted the specifications of the American Society for Testing Materials for plain or unreinforced concrete pipe and for reinforced concrete pipe. As a member of the Joint Concrete Culvert Pipe Committee, it cooperated in the preparation of the specifications for reinforced concrete culvert pipe. A condition survey of 191 existing reinforced concrete pipe sewers in 1929, covering 43 cities and steel plants of the country, revealed the need for a recommended practice for bedding and backfilling pipe lines. It was felt that misuse of the product by engineers and contractors often nullified the benefits of standardization by the manufacturer. A similar survey is now being carried on in the States of New Jersey, Pennsylvania, and Washington on the condition of existing reinforced concrete pipe culverts. It is expected that this survey will develop data which can be

used in the preparation of a recommended practice for bedding and backfilling, as well as in the revision of the existing culvert pipe specification. The association cooperated in the preparation of the American standard for drain tile. It is represented on the specification committee on sewers of the American Society of Municipal Engineers.

American Construction Council, Dwight L. Hoopingarner, executive, 28 West Forty-fourth Street, New York, N. Y. Although not directly engaged in standardization work, the council assists the construction industry in developing community building standards and in devising methods for securing quality building materials. It is engaged in the nation-wide program on the rebuilding of slum, semislum, and obsolescent districts in the larger and medium-sized cities of the country, a phase of which is the formulation of standards for city-planning codes of practice, ordinance requirements, and uniform laws.

American Dental Association, Harry B. Pinney, secretary, 212 East Superior Street, Chicago, Ill. This organization is interested in the standardization of the materials used in the construction of dental restorations and in the quality of medicinal preparations used by the dental profession. Its research commission is supporting research activities at the Bureau of Standards for developing specifications for materials and for improving methods of utilizing these materials. This has resulted in the publication of standards for dental amalgam alloys, inlay casting investment, inlay casting waxes, and impression compounds. Specifications for three types of inlay casting golds are being prepared for publication and work is in progress toward the development of specifications for wrought clasp and orthodontia alloys. Specifications for other types of casting golds and other dental materials are scheduled for development as rapidly as the available personnel will permit. Manufacturers of dental materials have been asked to certify that their products meet the published specifications. In addition to the certificate itself, satisfactory evidence of physical tests must be submitted to show that the manufacturer has tested his material and that its properties meet the requirements. A list of products so certified is being prepared for publication. This association maintains in the Chicago headquarters a bureau of chemistry, which was organized primarily to give to dentistry and to the public information on dental proprietary remedies and dental nostrums. The bureau publishes reports of these types of materials in the Journal of the American Dental Association. Articles on dental materia medica have also originated in this bureau, and preliminary investigations have been made of a number of products. It also examines new proprietary products with the view to preparing chemical specifications. The council on dental therapeutics of the association was organized as a permanently functioning body to advise the dental profession and the public concerning dental proprietary and nonofficial remedies and materials with regard to their composition and therapeutic usefulness. Its endeavors are directed toward protecting the dental profession and the public against fraud, undesirable secrecy, and objectionable advertising in the marketing of proprietary and nonofficial articles. The council consists of 10 members, 5 from the dental profession and 5 from related scientific fields. It lists materials as "accepted nonofficial dental remedies" when the articles are found to comply with the following rules: The composition of the article must be published; tests for determining its composition must be furnished; it must not be advertised to the public (except that disinfectants, dentifrices, and medicinal foods may be advertised within certain limits), there must be no false or misleading statements as to its origin, preparation, or therapeutic value; its name must not be misleading and it must not be useless.

American Dental Trade Association, George A. Lilly, managing director, 839 Seventeenth Street NW., Washington, D. C. One of the outstanding standardization activities of this organization has been the adoption of a uniform catalogue for the use of the dental supply dealer. Standardization and simplification have been carried out on the subjects of finishes for equipment, lathe-shaft ends, crown and bridge cement, base-plate wax, gold shell lengths, felt wheels and cones, chamois wheels, mechanical saws, gold files, vulcanite files, and electrical receptacles. Similar work is going forward on numerous other items used in the dental trade. The association sponsored the simplified practice recommendations for dental hypodermic needles, dental brush wheels, and packaging of dental plaster, investments, and artificial stones; it is sponsoring also the simplified

practice project for dental lathe grinding wheels.

American Drop Forging Institute, Paul A. Androus, secretary, 405 First Trust and Deposit Building, Syracuse, N. Y. Acting as joint sponsor this association cooperated with other organizations in the establishment of a safety code for forging and hot metal stamping under the procedure of the American Standards Association.

American Drug Manufacturers Association, Carson P. Frailey, secretary, Albee Building, Washington, D. C. Several years ago this association adopted standard dimensions and capacities for Blake tablet bottles. For the purpose of catalogue simplification it has recently adopted standard titles for pharmaceuticals in general use, covering elixirs, sirups, and simple tablets. Its committees on alkaloid and drug standards, pharmaceutical investigations, chemical tests and standards, and control assays have been working during the past year with the revision committees of the United States Pharmacopœia and the National Formulary with the object of developing methods and standards which will give more concordant results and thus make it possible for the various laboratories to obtain better check results. The committee on analytical assay methods reported on a proposed new test for the determination of free alkali in milk of magnesia and made definite recommendations for the consideration of the U. S. P. revision committee. This committee also presented results obtained by a proposed method for the determination of ephedrine in oil solutions. The committee on digestive ferments and glandular products reported on a proposed standard for desiccated whole pituitary substance. The committee on vitamin assay of cod liver oil made definite recommendations and proposed detailed methods, and the scientific section of the association voted that these methods and recommendations be forwarded to the U. S. P. revision committee for consideration in preparing the official method for the eleventh edition of the Pharmacopœia.

American Dry Milk Institute (Inc.), Roud McCann, director, 221 North La Salle Street, Chicago, Ill. After two and one-half years' work in its own and commercial laboratories, the institute established standard methods of grading dry skim milk. These methods have been published in a pamphlet which includes also the recently formulated standard methods for analysis of dry skim milk. Through the institute's testing service, samples of dry milk may be quickly and impartially tested for compliance with the grading rules.

American Electric Railway Association, G. C. Hecker, general secretary, 292 Madison Avenue, New York, N. Y. During the past year 60 committees of the several divisions of this association were engaged in research, and have submitted reports for consideration by the association, of which 33 are concerned with the formulation or revision of standards and specifications. Special joint work with other national organizations was conducted on the subjects of trolley-wire design and specifications and on the matter of clearances for overhead working conductors in heavy traction service. In the purchases and stores division, a schedule of standard packaging for certain selected overhead-line material was prepared (in cooperation with the division of simplified practice of the Bureau of Standards) and work continued on the standardization and simplification of stock. In the rolling-stock division, the standardization of motor-coach design and construction has been studied; further progress has been made on the standardization of various maintenance practices connected with motor-coach operation; work was completed on the special research being conducted at the Bureau of Standards on the various types of car drives; lighting practice for street cars, motor coaches, shops, office, and yard was further developed and standardized; the standards for journal boxes, journal bearings, brake shoes, and limits of wear were revised to bring them in accord with modern practice; the study of roller bearings for cars and new types of current collecting devices continued; regulations for the wiring of trolley buses were submitted; and there was also continued the joint work with the steam railroad groups on the preparation of designs for large size drive axles. In the way and structure division, further revision and standardization was carried on for the following items: Tie rods; track bolts and nuts, rail sections and associated splice bars, wheel and rail contours; wood preservation; welding rods; branding of rails; tables giving in convenient form the mathematical properties of rail sections; track and pavement construction; and foundations for special track work. During the past year, the 1931 Supplement to the Engineering Manual of the association was issued to bring the 1930 edition of this manual up to date.

The association is a member of the American Standards Association and through it takes active part in the consideration of all standards and specifications affecting the electric-railway industry. It is represented on the Electrical Standards Committee of that body. It has submitted to the American Standards Association a number of standards which have been approved by that body, and it is sponsor or joint sponsor for 13 projects, as follows: Insulated wires and cables for other than telephone or telegraph use; tubular steel poles; 600-volt direct current overhead trolley construction; designs for 7 and 9 inch girder-grooved and girder-guard rails and joint plates therefor (includes 6 projects); designs for 7-inch 82-pound, 92-pound, and 102-pound plain girder rail for use in paved streets (includes 3 projects); and special trackwork material.

American Electrochemical Society. (See Electrochemical Society, p. 331.)

American Electro-Platers Society, H. A. Gilbertson, secretary, 434 South Wabash Avenue, Chicago, Ill. By its representation on the sectional committee of the American Standards Association, this society is cooperating in the preparation of American standard specifications for zinc coating of iron and steel. This work has already resulted in a tentative standard for zinc coatings on structural steel shapes, plates, and bars and their products. The society also cooperates with the American Society for Testing Materials and the Bureau of Standards in research work on the protective value of various metals on steel.

American Face Brick Association, George S. Eaton, secretary-treasurer, 205 West Wacker Drive, Chicago, Ill. This organization was joint sponsor with the Common Brick Manufacturers Association of America for the simplified practice recommendation relating to sizes of face and common brick. It has published a skeleton specification suggested for the use of consumers of face brick. Through cooperation with manufacturers of lime and masonry cements, a research associate is retained at the Bureau of Standards for work on mortars. One of the association's committees developed a set of grading rules for face brick which was adopted by the association in November, 1931. The association is represented on the A. S. A. autonomous sectional committee on recommended practice for brick masonry.

American Foundrymen's Association (Inc.), R. E. Kennedy, technical secretary, 222 West Adams Street, Chicago, Ill. The association sponsored the joint committee on pattern equipment which formulated standards for pattern and core-box color markings and for pattern plate lugs and vibrators, as well as the joint committee on foundry refractories, which prepared standards for shapes and sizes of malleable furnace refractories. The association has adopted standard methods of testing and grading foundry sands worked out by its committee on foundry sands. The foundry safety and sanitary code developed in cooperation with the National Founders Association has been approved as a tentative American standard. The organization is joint sponsor with the American Ceramic Society for the joint committee on standardization tests for foundry refractories, and with the American Society of Mechanical Engineers for a joint committee to consider standardization of foundry equipment. It is joint sponsor for 3 A. S. A. sectional committees, and is represented on 10 others.

American Fruit and Vegetable Shippers Association, E. S. Briggs, manager-secretary, Room 404 Fruit Distributors Building, Corner Solon Street and Fourteenth Place, Chicago, Ill. Standard rules and definitions of trade terms for the fruit and vegetable industry have been adopted by this association in conformity with rules of the United States Department of Agriculture for use in connection with transactions coming under the perishable agricultural commodity act of 1930 coupled with advisory rules and definitions adopted by various other fruit and vegetable associations. The Chicago potato division of the association has adopted standard forms for inspection of cars and condition of the potato shipment, the brokers division has adopted a standard form of brokers' agency contract, and the Chicago watermelon division has adopted a standard form of sales ticket and railway delivery order. A standard confirmation of sales form for transactions in fruits and vegetables has been adopted by the association. Committees of the association are cooperating with the United States Department of Commerce and the Freight Container Bureau of the American Railway Association in preparing standards for containers; other committees are cooperating with the United States Department of Agriculture in the preparation of standards

for foods. Efforts are being made by the association to obtain closer cooperation between the various container standardizing agencies in the interest of better transportation of goods.

American Gage Design Committee, H. W. Bearce, secretary, Bureau of Standards, Washington, D. C. This committee, which was originally formed in 1926 at the suggestion of the Ordnance Department, United States Army, to assist in formulating standard designs for gages much used by that department, has had the fullest cooperation of large manufacturers and users of plain and thread-plug and ring-limit gages, and the designs approved by the committee have come into wide use in industry and have been approved as a commercial standard.

American Gas Association (Inc.), Alexander Forward, managing director, 420 Lexington Avenue, New York, N. Y. Through research activities conducted at its own testing laboratory and those of other organizations and institutions, this association has established safety and performance requirements for hot plates and laundry stoves, portable incinerators, clothes dryers, and flexible gas tubing, gas ranges, gas water heaters, space heaters, gas-heater ironers, and central house-heating appliances, as well as house piping and appliance installation. Work is nearing completion on requirements for garage heaters, hotel and restaurant ranges, high-pressure boilers, and installation of conversion burners, and on the utilization of mixed gases. Manufacturers of appliances which have been approved by the association's testing laboratory as complying with its safety and performance requirements are permitted to attach to the appliances the official approval seal of the association. A committee of this association is engaged in fundamental research relating to the standardization of orifice meters for large-volume high-pressure gas transmission lines and is also developing basic formulas for calculating the capacity under varying conditions of long-distance high-pressure lines. The association maintains two research associates at the Bureau of Standards for investigating gas combustion, pipe corrosion, protective coatings, gas-burner design, etc. It cooperated in the establishment of the commercial standard relating to standard weight malleable-iron or steel screwed unions. The association is sponsor for the A. S. A. sectional committee on gas appliances and joint sponsor for the sectional committees on specifications for cast-iron pipe and special castings, pipe threads, and gas safety code. It is also officially represented on the A. S. A. Safety Code Correlating Committee. The association participates in the standardizing activities of various other national organizations, including the American Society for Testing Materials.

American Gear Manufacturers Association, T. W. Owens, secretary, 3608 Euclid Avenue, Cleveland, Ohio. Acting as joint sponsor, this association cooperated with other organizations in the establishment of the American tentative standard for spur-gear tooth form, under the procedure of the American Standards Association. Projects are still under way on the standardization of nomenclature, helical gears, worm gears, bevel gears, materials, inspection, and power ratings of gears. This association is likewise joint sponsor on the A. S. A. project for transmission chains and sprockets. This activity has resulted in the American standard for roller chains, sprockets, and cutters, with work still under way on the standardization of silent chains. Official representation is maintained by the association on the A. S. A. project for the standardization of shafting which has resulted in the tentative standards for dimensions and design of transmission shafting and dimensions of shaft keys.

American Grocery Specialty Manufacturers Association, H. F. Thunhorst, secretary, 53 Park Place, New York, N. Y. This association has been active in the work of standardizing the order books of its members and is now engaged in formulating standard invoice forms. The association's technical committee on soaps cooperated with a similar committee of the Federal Specifications Board in the preparation of Federal specifications for soaps which have been promulgated and adopted for use by the various departments of the Federal Government.

American Hardware Manufacturers Association, Charles F. Rockwell, secretary, 342 Madison Avenue, New York, N. Y. In cooperation with the National Hardware Association of the United States, this organization assisted in the establishment of commercial sizes for steel sheets which are set forth in the simplified-practice recommendation covering this commodity. The association is officially

represented on two A. S. A. sectional committees.

American Home Economics Association, Alice L. Edwards, executive secretary, Mills Building, Washington, D. C. In the development of more enlightened purchasing practices on the part of household buyers, this association has been conducting an extensive educational program through its various associated societies and through publications in its Journal of Home Economics. The association considers that the most valuable services it can render in the standardization movement is to represent the intelligent consumer's point of view to those who are concerned with the production and distribution of consumers' goods. It is a member body of the American Standards Association, and is represented on A. S. A. sectional committees now working on the standardization of plumbing equipment, standards and specifications for refrigerators, specifications and standards for bed sheets and sheeting, and approval and installation requirements for domestic gas-burning appliances. It cooperated with units of industry in the formulation and acceptance of commercial standards for dress patterns, men's pajamas, wall paper, and plate-glass mirrors. Representatives of the association took part in the establishment of standards which have not as yet been promulgated, including commercial standard for colored sanitary ware, commercial standard for knit underwear, and simplified practice recommendation covering sizes and varieties of ice cream cups. Articles on standardization and its benefits to the consumer have been appearing in the association's journal for the last five years, and include such subjects as textile standardization, tests and specifications for the household, the consumer and standardization in food products, progress toward standardization and labeling in weighted silks, purchasing problems of the household buyer, method for determining the thickness of pile and napped fabrics, etc. The association is cooperating in a research study on the changes in solubility and absorption spectra of silk fibroin caused by tin weighting. It publishes suggestions for club programs, including the discussion of methods of household purchasing, labeling of commodities with information concerning their properties, use of standard specifications, etc. Twenty-five of the affiliated State home economics associations have committees on standardization and are active in promoting the association's standardization program. The division on textiles and clothing has taken up work on the simplification of clothing terminology. At the 1931 annual meeting of the association resolutions were adopted by which the members pledged themselves to cooperate with the retailers in their own communities to further the purchase and sale of consumers' goods labeled according to standards set up through the American Standards Association, the Bureau of Standards, or the Bureau of Agricultural Economics of the United States Department of Agriculture, or labeled in some other way with accurate measurements as to quality and performance. The association also indorsed the efforts being made by its committee on commercial standardization and simplification to secure labels on staple textile materials by which the quality specifications for the material will appear on the label. The formation of a consumers' research council under the auspices of the association is being considered. One of the purposes of such a council would be the development and use of scientific purchasing information for the ultimate consumer.

American Hospital Association, Dr. W. P. Morrill, chairman of committee on simplification and standardization, Maine General Hospital, Portland, Me. Since 1923 this association has had standard specifications for the purchase of meats, various canned fruits, and canned vegetables. It has also adopted and published 57 of the specifications of the Federal Specifications Board dealing with commodities most commonly used by hospitals. It cooperated with other units of the industry in the formulation and acceptance by industry of the commercial standard for clinical thermometers, issued by the Bureau of Standards and also cooperated in the formulation of the proposed commercial standard covering quality requirements and dimensions of steel bone plates. Simplification movements were initiated by this association looking to the establishment by industry of a limited number of standard sizes and varieties of hospital equipment, and these activities resulted in the simplified practice recommendations for hospital beds, hospital chinaware, hospital and institutional cotton textiles, and hospital plumbing fixtures, all of which are promulgated by the Bureau of Standards. The association is represented on four A. S. A. sectional committees.

American Hotel Association of the United States and Canada, Thomas D. Green, president, 221 West Fifty-seventh Street, New York, N. Y. Activities of this association in the field of standardization are carried on in cooperation with other organizations. Under American Standards Association procedure, it cooperated in the establishment of the American building exits code and the safety code for elevators; work is still in progress on four other projects. This association sponsored the movement which resulted in the adoption by industry of the simplified practice recommendation on sizes and varieties of hotel chinaware.

American Institute of Architects, Structural Service Department, F. Les. Smith, technical secretary, 1741 New York Avenue NW., Washington, D. C. This institute is so organized that its representatives on standardizing committees are able to reflect the group opinions of the architectural profession. It has cooperated with other organizations in the preparation of simplified practice recommendations for about 35 building materials and appliances. The institute has issued several standard contract forms which are now in the fourth or fifth edition. The institute has been instrumental in the formulation of recommendations as to size and character of advertising matter intended for architects, and the development of a standard filing system for trade literature. It represents the architectural profession on a large number of committees of organizations dealing with the standardization of building materials and appliances, such as the National Committee on Wood Utilization, the American Society for Testing Materials, the National Fire Protection Association, and the American Standards Association.

American Institute of Baking, Henry Stude, president, 1135 Fullerton Avenue, Chicago, Ill. Conducted by the American Bakers Association for scientific research and education, this organization operates laboratories for the analysis of ingredients, for teaching the value of laboratory control in bakery operation, and for standardizing raw materials. It conducts a bread-scoring department to which members may send bread for evaluation in physical characteristics and comparison with the products of other bakers. The institute has adopted and is encouraging the use of a standard bread-scoring form on which members themselves may grade their bread, and by a daily comparison of results, raise their standards of quality. The institute also advocates the grading of all other bakery products and of the bakery itself, in order to improve not only the quality and uniformity of the products but also the methods of manufacture and merchandising. It operates a school for the training of employees of members in baking technology and its application in daily operation, and supports the Louis Livingston Library of Baking.

American Institute of Chemical Engineers, Frederic J. LeMaistre, executive secretary, Bellevue Court Building, Philadelphia, Pa. Through its committee representation, this institute cooperates with other organizations in standardization work carried on under the auspices of the American Standards Association. This work has resulted in an American recommended practice for the identification of piping systems, and work is still in progress on a standard code for design, test, and installation of pressure piping systems, specifications for pressure and vacuum gauges; and standard scientific and engineering symbols and abbreviations. Another committee of the institute cooperated with the American Society of Mechanical Engineers in the preparation of the latter's evaporator test code.

American Institute of Electrical Engineers, F. L. Hutchinson, national secretary, 33 West Thirty-ninth Street, New York, N. Y. The revised standards of the institute are being published in the form of individual sections. Thirty-eight sections, each dealing with standards for a specific subject, have been completed. Of these 38 standards, 19 have been approved as American Standards under American Standards Association procedure. In cooperation with the Bureau of Foreign and Domestic Commerce, Spanish translations of 16 of the American Institute of Electrical Engineers standards have been made, and 41 have been published as United States Government documents. The institute is a member body of the American Standards Association and is represented on the electrical standards committee. It is sponsor or joint sponsor for 25 sectional committees. Of these it is joint sponsor with the National Electrical Manufacturers' Association for the following 12 projects: Industrial electrical control apparatus; alternators, synchronous motors, and synchronous machines in general; direct and alternating-current fractional horsepower

motors; synchronous converters; induction motors and induction machines in general; direct-current rotating machines; insulators for electric power lines; electric-arc-welding apparatus; electric resistance welding apparatus; oil circuit breakers; disconnecting and horn-gap switches; and electrical measuring instruments. It is also sponsor or joint sponsor for instrument transformers; hard-drawn aluminum conductors; mercury-arc rectifiers; railway motors; railway control apparatus; storage batteries; electrical definitions; insulated wires and cables for other than telephone and telegraph use (with nine other organizations); radio (with the Institute of Radio Engineers); scientific and engineering symbols and abbreviations (with four other organizations); code on protection against lightning (with the Bureau of Standards); symbols for electrical equipment of buildings (with two others); mine locomotive control apparatus (with two others). Committees of the institute are now at work on the following standardization topics: Lightning arresters; recording instruments; technique of temperature measurement, rule for altitude correction capacitors and fuses. Recommendations on the operation of transformers have been issued. Preliminary steps have been taken for the development of a series of electrical test codes. The institute also has been engaged for many years in safety-code work through its technical committee on safety codes.

American Institute of Homeopathy, Garth W. Boericke, M. D., chairman, pharmacopœia committee, care of Hahnemann Medical College, 235 North Fifteenth Street, Philadelphia, Pa. The pharmacopœia committee of the institute prepared the Homeopathic Pharmacopœia of the United States, first issued in 1897, which lists, describes, and gives standard strengths of tinctures, dilutions, medications, and triturations for all drugs which have a recognized use in the preparation of homeopathic remedies. The third edition of this publication is now undergoing revision. Changes will be issued in the form of a supplement. In addition to corrections and additions, this supplement will contain certain methods of test which have been approved by the committee. The committee has recommended that pharmacists whose products comply with these tests be given the right to so label them and that the medical profession be advised to confine its purchases to such standardized preparations.

American Institute of Mining and Metallurgical Engineers, A. B. Parsons, secretary, 29 West Thirty-ninth Street, New York, N. Y. Through its various committees the institute conducts important work in standardization relating to the mining industry. A final report dealing with dangers from oil and gas wells to coal-mining operations, and draft of a model law for use of the legislature of any State concerned have been adopted by the institute. A committee of the metals division of the institute cooperated with the division of simplified practice in the establishment of the simplified-practice recommendation for malleable foundry practices. During the past year the subcommittee on mine ventilation issued a proposed safety code for coal-mine ventilation for consideration by the institute's coal division. The institute is a member body of the American Standards Association and is officially represented on the mining standardization correlating committee. It is serving as sponsor for two projects on methods for screen testing of ores and recommended practices for rock dusting of coal mines, and is officially represented on 14 additional sectional committees dealing with safety codes, equipment, and recommended practices in mines. It has recently initiated a project dealing with the possible development of standard specifications for clean bituminous coal.

American Institute of Refrigeration, J. F. Nickerson, general secretary, 435 North Waller Avenue, Chicago, Ill. Committees of the institute are actively cooperating with several organizations in work leading to the formulation of standards for cast-iron flanged ammonia and screwed fittings, refrigerating piping, and pressure and vacuum gauges. The institute is officially represented on five sectional committees functioning under American Standards Association procedure.

American Institute of Steel Construction (Inc.), Charles F. Abbott, executive director, 200 Madison Avenue, New York, N. Y.; Lee H. Miller, chief engineer, 1050 Leader Building, Cleveland, Ohio. In its Standard Handbook of Steel Construction are included the following standard specifications which have been adopted by the institute: Specification for the design, fabrication, and erection of structural steel for buildings; A. S. T. M. specifications for structural

steel for buildings; code of standard practice governing contracts between buyer and seller; specifications for fireproofing structural steel buildings; and recommendations of the United States Department of Commerce for the minimum allowable live loads for buildings. These standards have already been accepted by 328 cities and 15 State bodies. Members of the institute who adhere to its code of standard practice are permitted to use the institute's symbol as a label for their commodities. The institute maintains two research associates at the Bureau of Standards working on fire tests on battle-deck floor construction and formed sheet steel floors.

American Institute of Weights and Measures, W. E. Bullock, secretary, 33 Rector Street, New York, N. Y. The institute is not a standards-making body. It concerns itself with the collection and classification of legislative and industrial records relating to standards of measurement. It is at present collecting data on international standards of measurement as the basis of international standardization in manufacture.

American Leather Belting Association, J. L. Nelson, secretary, 41 Park Row, New York, N. Y. Activities of this association in the field of standardization are confined largely to the preparation of specifications for vegetable-tanned leather belting. It cooperated with a technical committee of the Federal Specifications Board in the preparation of Federal specifications for such belting. It is now cooperating with the American Society of Mechanical Engineers, which organization is serving as sponsor for a project relating to specifications for leather belting, functioning under the rules of procedure of the American Standards Association. A joint committee on the use and care of transmission belting is now being organized.

American Leather Chemists Association, H. C. Reed, secretary, 143 West Twentieth Street, New York, N. Y. The following official methods of analysis have been adopted by this association: Vegetable materials containing tannin, sampling tannin materials, vegetable tanned leather, chrome leather, sulphonated oils, and a form for the reporting of extract analysis. It has also adopted provisional methods for analyzing various leathers and tanning materials. In addition it has adopted a provisional international method for the analysis of vegetable materials containing tannin and a provisional method for the analysis of miscellaneous tannery materials.

American Machinery and Tools Institute, George R. Tuthill, executive secretary, 40 North Wells Street, Chicago, Ill. The standardizing activities of this organization are carried on by a committee appointed by the president and authorized to collect and further the distribution of accepted standards as developed from recognized authoritative sources, and to originate, develop, and present such standards as will constructively advance the usefulness of the machinery and tools industry. The results of the committee's work are first adopted by the board of directors and then submitted to the entire membership of the institute for final approval and adoption. The committee has prepared a standard classification of jigs used in the drilling, reaming, boring, countersinking or tapping of duplicate piece parts, also a standard estimate sheet. Work is going forward on the standardization of milling fixtures, of methods for tool inspection, tool inspection equipment, and methods of inspection of materials, including thin spring steel, thin zinc, and mechanical rubber sheets, tubes, and bars.

American Marine Standards Committee. (See Ch. VIII, p. 284.)

American Medical Association, Chemical Laboratory, Paul Nicholas Leech, director, 535 North Dearborn Street, Chicago, Ill. The specifications for drugs accepted for inclusion in New and Nonofficial Remedies (which are of a chemical nature) have been prepared by the chemical laboratory. The laboratory also examines drugs purchased from time to time on the open market to determine if they comply with the standards and conducts original investigations in the field of materia medica.

American Medical Association, Committee on Foods, Raymond Hertwig, secretary, 535 North Dearborn Street, Chicago, Ill. The committee on foods publishes a list of accepted foods as conforming to the requirements laid down by the committee. According to the present status, all foods which are merchandised under a label and which are advertised may come within the scope of the committee's consideration. The food products submitted to the committee must be accompanied by detailed information on manufacture, chemical composition, ingredients, and any data in support of unusual claims. The committee on foods grants the privilege of the display of its "seal of acceptance" to show

that the accepted products comply with the requirements. The seal, if displayed on the package, must be the only seal on the package and must not appear in conjunction with the seal of any other investigative organization.

American Medical Association, Council on Pharmacy and Chemistry, W. A. Puckner, secretary, 535 North Dearborn Street, Chicago, Ill. The council on pharmacy and chemistry publishes each year a book, New and Nonofficial Remedies, in which are listed and described such medicinal preparations as have been accepted by the council on pharmacy and chemistry in accordance with its rules (copies of which may be obtained on request). The descriptions or specifications of accepted articles are based in part on investigations made by, or under the direction of, the council and in part on evidence or information supplied by the manufacturer or his agents. The council also reports on drugs not found acceptable and gives the reasons therefor. The council on pharmacy and chemistry grants the privilege of the display of its "seal of acceptance" to show that the accepted products comply with the requirements. The seal, if displayed on the package, must be the only seal on the package and must not appear in conjunction with the seal of any other investigative organization.

American Medical Association, Council on Physical Therapy, H. A. Carter, secretary, 535 North Dearborn Street, Chicago, Ill. The council on physical therapy publishes a list of apparatus for use in physical therapy, which, after a consideration of the evidence, has been declared acceptable as conforming to the rules of that council. If an apparatus is not found acceptable, a report is published which states the reasons for objections and points out the violations of the rules of the council.

American Mining Congress, J. F. Callbreath, secretary, Munsey Building, Washington, D. C. Through its national standardization program, this organization has prepared and adopted 11 standards, 8 of which have been approved by the American Standards Association. Committees of the standardization division are engaged in work on the following projects: Mechanical loading of coal, mine timbering, mine timber preservatives, metal-mine cost accounting, drilling machines and drill steel, locomotives for coal mines, safety rules for installing and using electrical equipment in metal mines, and coal-mine cars. This organization is sponsor or joint sponsor for 14 A. S. A. sectional committees.

American Oil Burner Association (Inc.), Harry F. Tapp, executive secretary; W. C. Schoenfeldt, technical secretary, 342 Madison Avenue, New York, N. Y. In its work in standardization this association has recommended a model ordinance governing the construction and installation of oil-burning equipment for use by municipal authorities having jurisdiction over such installations. In order to encourage the use of this ordinance, the association publishes and issues a circular entitled "For Clean Cities—Oil Heat and Constructive Municipal Regulation." It has adopted an advertising code, general trade practices, and standards of business conduct. The association cooperated with the Bureau of Standards in the establishment of the commercial standard for domestic and industrial fuel oils. A technical research program, including the test of various types of oil burners under various conditions, sponsored by this association and the American Society of Heating and Ventilating Engineers, is being conducted in cooperation with the Sheffield Scientific School of Yale University. The association maintains and operates the Oil Heating Institute. It is officially represented on three A. S. A. sectional committees.

American Oil Chemists Society, J. C. P. Helm, secretary, 705 Tchoupitoulas Street, New Orleans, La. The society has adopted and published the standard methods for sampling and analysis of commercial fats and oils prepared by the committee on analysis of commercial fats and oils of the American Chemical Society. In cooperation with the National Cottonseed Products Association, it has adopted official methods of chemical analysis for cottonseed, cottonseed hulls, crude cottonseed oil cake, meal, and meats, and associated oils. The detergents committee of the society is cooperating with the Bureau of Standards in a study of practical washing tests, with a view to formulating a standard performance test to measure the cleansing power of detergents. The soap analysis committee is continuing its cooperative work on developing a standard method for determining unsaponifiable matter in filled soaps containing rosin, lanolin, etc., and is preparing to review and revise the standard methods of sampling and analysis

of soap and soap products, adopted by this society and the American Chemical Society.

American Optometric Association (Inc.), Edwin H. Silver, associate director, department of research, 1410 G Street NW., Washington, D. C. A national advisory commission on vision for motor drivers, appointed by this association at the instance of the National Conference on Street and Highway Safety, has prepared standards of visual acuity for motor-vehicle operators. In cooperation with the National Research Council, an investigation is being made of limits of safety vision. The motor vision commission of the association has issued a report in the interests of standard State licensing requirements for automobile drivers.

American Paint and Varnish Manufacturers Association (Inc.), G. V. Horgan, general manager, 2201 New York Avenue NW., Washington, D. C. A joint committee, composed of representatives of this association and the National Paint, Oil, and Varnish Association, is engaged in simplifying the number of sizes of containers and color varieties in paints and varnishes. The association is officially represented on the A. S. A. sectional committee on electric motor frame dimensions.

American Paper and Pulp Association, Jesse H. Neal, general manager, 370 Lexington Avenue, New York, N. Y. Advisory committees of this organization collaborate with the various agencies of the Federal Government on technical matters relating to the manufacture of pulp and paper. The association cooperated with the Bureau of Standards in the establishment of the simplified practice recommendation covering sizes and grades of paper. In cooperation with the National Paper Trade Association, the committee on simplification and standardization of this association is making a study of the standardization of sample-book sizes and a simplified system of filing these sample books in the offices of printers, advertisers, and advertising agencies. The association is officially represented on A. S. A. sectional committees on safety codes for conveyors and conveying machinery and paper and pulp machinery.

American Petroleum Institute, W. R. Boyd, jr., executive vice president, 250 Park Avenue, New York, N. Y. Through its division of production, under whose auspices function the various committees on the standardization of oil-field equipment, this institute has adopted the numerous standards and specifications for supplies and equipment used in the petroleum industry, and has adopted several codes on recommended practice in this field. On recommendation of the general committee on refinery technology, the institute adopted 21 standards of the American Society for Testing Materials for methods of test for petroleum products. It cooperated with the Bureau of Standards in the establishment of commercial standards for diamond-core drill fittings, domestic and industrial fuel oils, and steel and wrought-iron pipe nipples. As an aid to international interchangeability in pipe threads and limit gauges, the institute has completed arrangements with the Government laboratories of America, England, and Germany by which each of these national standardizing institutions is made an official testing and certifying agency for thread gages made in accordance with the specifications of the American Petroleum Institute and so designated in the institute's specifications for tubular goods. In promoting the use of its standards and specifications throughout the industry the institute grants to manufacturers the right to place its official monogram on certain standardized equipment certifying that the material so marked complies with all of the conditions and standards contained in the official publications relating thereto. The institute reserves the right to revoke the use of its monogram for any reason satisfactory to the board of directors. This institute, together with the National Automobile Chamber of Commerce and the Society of Automotive Engineers, maintains a group of research associates at the Bureau of Standards working on properties and chemical constituents of petroleum products, protective coatings for pipe lines, automotive engines, cooperative fuel research, etc. It is officially represented on 14 sectional committees functioning under the rules of procedure of the American Standards Association.

American Pharmaceutical Association, E. F. Kelly, secretary, 10 West Chase Street, Baltimore, Md. Committees of this association are functioning on such subjects as the revision of the National Formulary, a publication supplemental to the United States Pharmacopœia; physiological testing of drugs; cooperation with foreign associations in bringing about international uniformity in pharmaceutical nomenclature; minimum re-

quirements for course to be taught in various colleges of pharmacy (in cooperation with American Association of Colleges of Pharmacy and National Association of Boards of Pharmacy); preparation of unofficial standards for drugs and chemical products; publication of a recipe book, containing standard formulas and recipes not found in the Pharmacopœia or the National Formulary; cooperation with other scientific bodies on the question of horticultural nomenclature; extension of the use of the metric system in pharmacy; and investigation of the light-protecting properties of various colored glass containers and determination of the amount of protection afforded or deterioration produced by light from the ultra-violet and infrared regions of the spectrum, with a view to preparing specifications for colored glass containers for the protection of medicaments. In 1930 a conference of pharmaceutical law-enforcement officials was formed to bring about greater uniformity in the pharmaceutical legislation of the several States and in the enforcement of these laws. The association has recently cooperated in organizing the Inter-Society Color Council to develop uniform definitions and standards for colors.

American Public Health Association, Kendall Emerson, M. D., acting executive secretary, 450 Seventh Avenue, New York, N. Y. In cooperation with the American Water Works Association, this association has formulated standard methods for the examination of water and sewage. It has also revised its standard methods of milk analysis. The association's committee on research and standards is at present engaged in a series of standardization problems which include standard record forms for the tabulation of vital statistics and other projects in relation to public-health measures. It is officially represented on the sectional committee on code for the lighting of school buildings.

American Railway Association, H. J. Forster, secretary, 30 Vesey Street, New York, N. Y. The activities of this association are conducted under 9 divisions, 5 of which are concerned with matters which have led to the adoption of standards, specifications, and recommended practices, namely, operating (dealing with problems of operation); engineering, which deals with the location, construction, and maintenance of railroads; mechanical (conducting work in the construction and maintenance of rolling stock); purchases and stores (which deals with the purchasing, storing, distribution, and selling of materials and supplies); and freight claim, dealing with the formulation of standard recommended practices to govern freight losses and claims. (See sketches of the freight claim, mechanical, operating, and purchases and stores divisions; the American Railway Engineering Association, which functions as the engineering division of the American Railway Association; also the signal, and telegraph and telephone sections.) The association has organized two committees which do not function under the above-noted divisions; namely, the committee on automatic train control and the joint committee on grade-crossing protection. The former committee is engaged on the standardization of automatic train-control devices, and the latter is doing similar work for automatic highway grade-crossing signals.

American Railway Association, Electrical Section, E. H. Fritch secretary, 59 East Van Buren Street, Chicago, Ill. This section of the association is concerned with the application of electricity to railway service. It has formulated specifications covering the construction, operation, and protection of transmission and distribution systems, both overhead and underground.

American Railway Association, Freight Claim Division, Lewis Pilcher, secretary, 59 East Van Buren Street, Chicago, Ill. The duties of this organization are to standardize and harmonize, nationally and on a uniform basis, the rules and practices of carriers concerning the prompt and lawful settlement of freight claims with claimants and between carriers, also to study claim causes and the application of preventive measures. It publishes a book of Freight Claim Rules or manual of practices (revised annually) in which are carried the rules and standards prescribed for the investigation and interline apportionment of claims paid to claimants, lists of freight claim and prevention officers of carriers, uniform blanks, and other handy information for use of railroad freight claim offices. There are also published and distributed semiannually, in printed form, interpretations of freight claim rules as handed down by the appropriate committee of the division, there being included for ready reference a cumulative index-digest of such cases.

American Railway Association, Freight Container Bureau, Edward Dahill, chief engineer, 30 Vesey Street,

New York, N. Y. The chief function of this bureau is to develop standard containers for the many different commodities which are moved by freight and also to assist shippers on matters involving the packing and construction of containers. The bureau's engineers spend considerable time at the shipper's plants and especially in the fresh-fruit and vegetable producing territories, for the purpose of acquainting the shippers with the recommended standards for containers and methods of loading and bracing. The bureau cooperates very closely with Federal and State agencies in developing recommended standards for containers and methods for packing and shipping. Thirty-six recommended standards relating to various types of containers and packing, crating, and shipping of various commodities have already been formulated by the bureau. The standards developed and recommended for use by this bureau are not compulsory in nature. However, in some instances the recommendations have been accepted and adopted by tariff issuing agencies of the carriers throughout the country, in which case they have become standard in particular circumstances or in specified territories. The bureau has pending and in various stages of completion the following recommended standards: Method of packing and crating steel office furniture; crates for enameled iron sanitary ware; crating for vitreous china sanitary ware; and descriptions of damages and defects of enameled iron sanitary ware. The bureau's program for the coming year includes the following projects: Continuation of studies, field work and laboratory tests on a number of containers used in the fresh fruit and vegetable industry; development of standard methods for crating and boxing electric refrigerators and novelty furniture; and preparation of illustrated pamphlets or bulletins on standard methods of skidding and crating textile and laundry machinery, packing glassware and crockery in fiber-board boxes, and crates and loading methods for airplanes and airplane parts. It is also planning to issue an illustrated bulletin on standard skids, cradles, and crates for motor boats, and a general bulletin on materials, construction, packing, and closing of fiber boxes.

American Railway Association, Mechanical Division, V. R. Hawthorne, secretary, 59 East Van Buren Street, Chicago, Ill. This organization, representing an amalgamation of the former Master Car Builders Association and the American Railway Master Mechanics Association, is chiefly occupied with standardization and simplification of railway materials and practices in the field of motive power and rolling stock. Through the activities of its different committees and their investigations and studies, the division has adopted 156 standards and specifications for different parts of cars. In addition, 141 recommended practices have been accepted for investigation and trial with the expectation that they, or some modification thereof, would finally be adopted as standards and become the uniform practice of railroads. Ten standards and forty-two recommended practices pertaining to locomotives have been adopted. All of the division's standards are incorporated in a manual which is revised and supplemented annually. At the 1931 meeting of the division, various committees submitted for approval by the division reports on the following subjects: Revision of the loading rules; additions to the interchange rules; specifications for draft gears; advancement to standard of the type E coupler; adoption of standard swivel-butt coupler and yoke; standardization of method of operating uncoupling levers; standard location for air-brake retaining valves; capacity rating for car-lighting batteries; counterbalancing of locomotives; standard pressures for mounting driving, trailing, and engine-truck axles and crank pins; change in standard flange height for locomotive wheels; standard designs for eccentric cranks; adoption of American standard screw threads; adoption of the standard prepared by the Manufacturers Standardization Society of the Valve and Fittings Industry for 300-pound screwed pipe fittings for locomotives; standardization of 300-pound globe and angle valves for steam locomotives; recommended practices for journal boxes and journal wedges, limits for coupler heights on passenger cars, and brine-tank joints; standard design for placard holders on tank cars; specifications for helium cars; methods of patching tank cars; proposed revisions of chilled-iron wheel specification; standard brake beams, dummy hose couplings, contour lines for steam-hose couplings, and location of air signal, train line, and steam-heat pipe on passenger-equipment cars; recommended definition of a hot box; method of analysis of reclaimed waste; and standard journal bearing wedge condemning gage. The division

is represented on the A. S. A. standards council. The division is carrying on a considerable amount of research work, involving both laboratory and road-service tests. It maintains at Purdue University, Lafayette, Ind., an air-brake laboratory, draft-gear testing laboratory, laboratory for testing tank-car devices, brake-shoe testing machine, and an air-hose testing machine. The division also uses the laboratories of the various railroads and commercial companies manufacturing railway supplies for various research projects under the direction of committees of the division.

American Railway Association, Operating Division, J. C. Caviston, secretary, 30 Vesey Street, New York, N. Y. Specifications for track torpedoes; 5-minute red fusees; lanterns for use on crossing gates and by highway crossing watchmen and gatemen; standard bunting and signaling flags; and standard drawings relating to approach warning and stop signs, and painting for highway-gate arms have been prepared by this division. It publishes and keeps under constant revision the Standard Code of the American Railway Association relating to train, block signal, and interlocking rules, and also to standard definitions for the various terms used in railway operations.

American Railway Association, Purchases and Stores Division, W. J. Farrell, secretary, 30 Vesey Street, New York, N. Y. Committees of this division are actively engaged in preparing standards in order to bring about the highest efficiency and economy in the purchasing, handling, and distribution of materials and supplies in the railway industry. The division has adopted certain recommendations relating to the standardization of pipe fittings and valves, manhole and handhole gaskets, padlocks, and railway electrification materials. It has also adopted recommendations in connection with standard types of buildings for storing stock and equipment, paint and oils, explosives, oxygen, and acetylene; garages, and lumber sheds. The following standards prepared by its various subject committees have also been adopted by this division: Method of unit piling materials; rules for railroad stores department operation, including the standard stock book; reclamation practices; material classification; rules for railroad purchasing department operation, and reclamation practices. The division cooperated with the Bureau of Standards in the establishment of the simplified practice recommendation for commercial forms.

American Railway Association, Signal Section, R. H. C. Balliet, secretary, 30 Vesey Street, New York, N. Y. Committees of this section, either alone or in cooperation with similar committees of technical societies, trade associations, and other bodies are actively engaged in formulating recommended practices relating to signals and signaling devices used in the railway industry. This section revises and keeps up to date the drawings and specifications contained in its Manual of Recommended Practices dealing with design, construction, maintenance, and operation of railway signaling devices. During the past year it approved the adoption and in some cases revisions of the following recommended practices: Lead-covered cable, armored submarine cable; double-braided, weatherproof 30 per cent conductivity copper-covered steel line wire; direct current relays; caustic-soda batteries; time release and time lock; form for reporting material used and labor performed in construction; method for comparing operating results before and after an improvement in signaling facilities; car retarder system; electric motor switch operating mechanism; centralized traffic control system; centralized traffic control machine; electric lock; interlocking lever circuit controller; direct current track circuit test record; plug type rail bonds and track circuit connectors; rail bond (plug type); track circuit connector; relay contact post designation plate; made ground for protection against abnormal potentials; line transformer, oil-immersed, self-cooled; transformer oil; semaphore spectacle; wood signal blades; instrument cases (styles A, B, and C); base for instrument cases (styles A, B, and C); and highway crossing signal requisites.

American Railway Association, Telegraph and Telephone Section, W. A. Fairbanks, secretary, 30 Vesey Street, New York, N. Y. This section functions as a part of the operating division of the American Railway Association. In its loose-leaf manual and pocket handbook for use by supervisory engineering and field forces are included over 200 recommended specifications and practices for the advancement of efficiency of the telegraph and telephone departments of the railroad service and the standardization of the plant, equipment, and practices. Numerous standing committees are actively engaged in

keeping and formulating new practices or in revising existing ones. The following important subjects are now being considered by committees of this section: Communication transmission, radio and wire carrier systems, electrical protection, message traffic, economics, inductive interference, inside and outside plant, protection against electrolysis, accident and fire prevention, and education and training of employees. This section is officially represented on the sectional committees of the American Standards Association on all matters relating to the telegraph and telephone plant.

American Railway Association, Transportation Division, G. W. Covert, secretary, 59 East Van Buren Street, Chicago, Ill. This division had its origin in the activities of the former Association of Transportation and Car Accounting Officers and the Committee on Relations between Railroads of the American Railway Association. The duty of the transportation division is to formulate rules covering and report upon questions affecting, the uniform and efficient use and interchange of equipment. Its activities include the formulation, revision, and interpretation of the following rules: Code of car-service rules, code of per diem rules, code of switching reclaim rules, embargo regulations, national car-demurrage rules, uniform code of storage rules, national track-storage rules, regulations for the handling of railroad business mail, mileage allowances and rules governing the handling, also the payment of mileage, and the equalization of mileage on cars of private ownership, methods for loading carload freight, rules governing receipt, stowing, handling and delivery of less-than-carload freight, rules governing the application, inspection, recording and care of car seals, assignment of permanent reporting marks for use on cars of railroad and private ownership, supervision of checks to establish terminal-switching reclaim allowances.

American Railway Car Institute, W. C. Tabbert, secretary, 19 Rector Street, New York, N. Y. This organization cooperates with the Electric Railway Presidents' Conference Committee in the design and adoption of new electric railway car standards, and with various committees of the American Railway Association in the standardization of freight cars. The institute is officially represented on two A. S. A. sectional committees.

American Railway Engineering Association, E. H. Fritch, secretary, 59 East Van Buren Street, Chicago, Ill. The association functions also as the construction and maintenance section of the engineering division of the American Railway Association. Its Manual of Recommended Practice for Railway Engineering contains specifications for materials and workmanship, plans, designs, and general principles of practice for the construction and maintenance of track, bridges, buildings, and other appurtenances of the physical plant of railways. The association is joint sponsor for A. S. A. projects on specifications for movable railway bridges and specifications for insulated wires and cables (other than telephone and telegraph).

American Refractories Institute, Stuart M. Phelps, director of research and tests, Mellon Institute, Pittsburgh, Pa. Specifications for clay fire brick for malleable furnaces with removable bungs and for annealing ovens were formulated by this organization in 1926 and were approved by the joint committee of the American Foundrymen's Association and the American Ceramic Society. These specifications were adopted as standard in 1928 by the American Society for Testing Materials. Specifications for clay fire brick for stationary boiler service, and clay fire brick for marine boiler service, likewise adopted in 1928 by the A. S. T. M., were also developed by the institute. The organization cooperated with other units of industry in the establishment and acceptance by industry of standard sizes and varieties of malleable foundry refractories as promulgated in a simplified practice recommendation of the Bureau of Standards.

American Road Builders' Association, Charles M. Upham, engineer-director, National Press Building, Washington, D. C. The association functions as a clearing house to acquire and disseminate educational and scientific information concerning highway activity in the United States, Canada, Mexico, Central and South America, and many European countries. Its membership includes Federal, State, city, and county highway officials, honorary representatives of foreign countries, highway contractors, highway transport operators, producers of highway materials, and manufacturers of highway equipment. Group and general committees study problems relating to highway legislation, finance, design, construction, maintenance, equipment, and operation. Their efforts are directed toward development of improved standards which shall elimi-

nate waste, increase efficiency, and bring about economy in highway administration. To avoid unnecessary duplication in its research activities, the association cooperates through joint cooperating committees with other organizations, official and unofficial, having in part similar aims. The results of investigations on the various technical and general problems are presented in report form and discussed at the annual convention of the association. The final reports are summarized for publication in the convention proceedings and later issued with discussions in bulletins, of which there have been prepared 24 dealing with the purchase, operation, and maintenance of road-building equipment, and the selection and utilization of road-building material.

American Sanatorium Association, E. S. McSweeney, M. D., chairman, committee on standardization, 132 East Thirty-sixth Street, New York, N. Y. The committee on standardization of this association, which is a constituent organization of the National Tuberculosis Association, is continuing its work in the development of standards for tuberculosis institutions throughout the country. In its annual report issued in May, 1931, this association reaffirmed the existing minimum standards relating to the rating as to location, construction of buildings, and administration of the tuberculosis sanatoriums and hospitals in the United States. The committee is actively promoting standardization projects of local organizations and groups in various parts of the country, particularly those in New York City and State conforming in principle and essential data to those of the American Sanatorium Association.

American Society of Agricultural Engineers, Raymond Olney, secretary, St. Joseph, Mich. In 1925 this society adopted a tractor testing and rating code which has become the standard of the farm-equipment industry. During the past year it has adopted revised standards for design, dimensions, speed, location, etc., of spline shafts and spline hubs for power take-off for agricultural tractors and machines, and standard dimensions and concavity for a limited number of standard sizes of disk blades for disk plows, harrows, drills, listers, and cultivators. Work is now in progress on the development of a standard method for rating hammer type feed mills. This society cooperated with other organizations, under the procedure of the American Standards Association, in the formulation of the American standard specifications for drain tile and the tentative specifications for dimensions of plow bolts, and has representation on two other A. S. A. sectional committees.

American Society of Bakery Engineers, Victor E. Marx, secretary, 1541 Birchwood Avenue, Chicago, Ill. Standards formulated and adopted by this society for bakery equipment and approved by the Bakery Equipment Manufacturers Association, included dough mixers, storage bins, sifters and bolters, flour hoppers, and water tanks. Its standardization committee made specific recommendations on the standardizing of live or active belt capacities of belt proofers for various loaf sizes which were concurred in by equipment manufacturers. In 1931, the committee made certain recommendations on heights of cake depositor hoppers and the standard rating of cake mixers by weight of dough rather than by gallon capacity which have not yet been approved by the equipment manufacturers.

American Society of Civil Engineers, George T. Seabury, secretary, 33 West Thirty-ninth Street, New York, N. Y. Standardization work of the society is conducted through the appointment of committees to deal with certain projects and through representation on committees of other organizations. Research committees have been organized to carry on work relating to stresses in railroad track, irrigation hydraulics, concrete and reinforced concrete arches, steel columns, cement, earths and foundations, and dams. Special committees are also maintained by eight of the technical divisions of the society, studying the fields of city planning, construction, irrigation, power, sanitary engineering, structural engineering, surveying and mapping, and waterways. The society is jointly represented on committees of the American Bureau of Welding, American Marine Standards Committee, American Standards Association, and other bodies. It is officially represented on the Joint Committee on Concrete and Reinforced Concrete and on the committee on culvert pipe specifications. In cooperation with the American Public Health Association, the society has adopted standard definitions of terms used in sewerage and sewage disposal practice. The society is joint sponsor for two A. S. A. sectional committees on manhole frames and covers (with the A. S. A. telephone group) and

scientific and engineering symbols and abbreviations.

American Society of Heating and Ventilating Engineers, A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y. One of the very important functions of this society is the development of heating and ventilating codes and standards. Several of the more recent codes which have been developed by committees of the society are the following: Code for testing concealed gravity type radiation; code for testing steam-heating boilers burning oil fuel; performance test code for steam-heating solid fuel boilers; code for testing radiators; and standard test code for disk and propeller fans, centrifugal fans and blowers. The last-mentioned code was developed by a committee of this society in cooperation with a similar committee of the National Association of Fan Manufacturers. In addition, the society is giving consideration to several reports prepared by its committees relative to the formulation of codes on ventilation standards; testing and rating unit ventilators; and heating and ventilating garages. The society carries out its research program at its own laboratory located at the Bureau of Mines Experiment Station, Pittsburgh, Pa., and at 10 universities in different parts of the country. It is officially represented on seven A. S. A. sectional committees.

American Society of Mechanical Engineers, Calvin W. Rice, secretary, 29 West Thirty-ninth Street, New York, N. Y. The society has 16 professional divisions as follows: Aeronautics, applied mechanics, fuels, hydraulics, iron and steel, machine-shop practice, management, materials handling, national defense, oil and gas power, petroleum, steam power, printing machinery, railroads, textiles, wood industries, and a process industries group which is just being formed. Each of these professional divisions has a section of the society's Transactions, in which it publishes for reference its worthwhile technical papers with discussions. Each one functions almost as a separate small society and has the right to hold one national convention each year and to suggest research and standardization projects. The technical committee activities of the society has grown very rapidly during the past 12 years, until now approximately 1,850 engineers and others are serving on the 420 committees for which the society is sponsor or joint sponsor. In this work 227 organizations cooperate. Under the main research committee 29 special research committees have been organized. Some of the projects have grown out of the activities of the standard committees. At the present time some 38 research workers are engaged on a variety of projects. Ten research fellows at the Bureau of Standards are working on the experimental program of the research committees. A new project on the wear of metals is being formulated. The dimensional standardization and safety activities of the society are carried forward under the procedure of the American Standards Association. At the present time the society is sponsor or joint sponsor for 29 sectional committees on standards and 5 sectional committees preparing safety codes. Two of these committees deal with standardization activities recently inaugurated, namely, those for leather belting and foundry equipment and supplies. One of the society's most notable technical committee accomplishments is the development of the American Society of Mechanical Engineers' Boiler Construction Code, consisting of eight sections and interpretations, which has been officially adopted by 19 States and 16 cities in this country. The preparation of the society's standard tests of power-plant and heat apparatus, such as are most commonly undertaken in connection with commercial transactions, is in the hands of a group of 20 committees guided by the main committee on power-test codes. Each of these individual committees was organized to undertake the revision or formulation of a test code for such apparatus as boilers; steam engines, steam and hydraulic turbines; pumping machinery; compressors, blowers, and fans; locomotives; gas producers; and gas and oil engines. The society has published in pamphlet form 40 dimensional standards, 2 safety codes, 5 research reports, 6 bibliographies, and 20 power-test codes. The standards and technical publications of the society are broadly advertised in the technical and daily press during their development by technical committees, and page-proof copies are sent in quantity to interested societies, firms, and individuals. As a result, when the final pamphlet copies are available a reasonably broad distribution is immediately assured. The society's standardization committee plans to make a canvass of the extent of the adoption of a given standard on the second, third, and fourth anniversaries of its approval by the American Standards Association. In its me-

chanical catalogue special notations are employed to indicate those firms supplying equipment in conformity with standards approved by the American Standards Association.

American Society of Municipal Engineers, C. W. S. Sammelman, secretary, 4359 Lindell Boulevard, St. Louis, Mo. The society's specifications, which are kept in harmony with those of the American Society for Testing Materials, cover the subjects of standard municipal contract forms, sewers, sidewalks and curbs, pavements of various materials, broken stone and gravel roads, girder rails for use in paved street railway track, and asphaltic concrete. The society sponsored the movement for the establishment of the simplified practice recommendation for asphalt. It is represented on nine A. S. A. sectional committees.

American Society of Refrigerating Engineers, David L. Fiske, executive secretary, 37 West Thirty-ninth Street, New York, N. Y. Specifications for synchronous motors for direct-connected refrigerating compressors, and a test code for steam-driven ice plants have been adopted by this society which has also formulated and adopted a standard test code for refrigerating systems which is in harmony with that of the American Society of Mechanical Engineers. It is the author of a test code for refrigerators and a code for corrosion prevention. During the past year it appointed a committee to continue studies of the so-called "standard ton" relating to a standard measurement for refrigeration performance, and to extend its application to air-cooled condensers. The society served as sponsor for A. S. A. sectional committee B9 on safety code for mechanical refrigeration, and is joint sponsor with the Bureau of Home Economics of the United States Department of Agriculture for the sectional committee on standards and specifications for refrigerators. It is officially represented on eight additional sectional committees functioning under A. S. A. procedure.

American Society of Sanitary Engineering, James R. Walker, secretary, City Hall, Waterbury, Conn. Standardization is carried on by this society mainly through cooperation with other bodies engaged in this type of work. It began agitation for a national standard code for plumbing as early as 1906, later assisted the building code committee of the Department of Commerce in formulating such a standard code, and is now conducting a campaign for its general adoption. Cooperative work is being carried on with the Bureau of Standards in conducting tests of plumbing equipment for use in high buildings. It cooperated with other organizations, under the procedure of the American Standards Association, in the establishment of the American standard for pipe threads and is now acting as joint sponsor on the A. S. A. project for the standardization of plumbing equipment. Other incompleted projects of the A. S. A., on which this society is represented, include the standardization of screw threads for hose couplings other than fire hose and a safety code for industrial sanitation.

American Society for Steel Treating, W. H. Eisenman, secretary, 7016 Euclid Avenue, Cleveland, Ohio. Although this society has formulated no quality specifications or dimensional standards, it has issued a handbook in which are incorporated all standard and tentative recommended practices formulated by its technical committees on treatments of steels. Through a joint committee composed of representatives of the American Society for Testing Materials, the Society of Automotive Engineers, and this society, standard definitions of terms relating to heat-treatment operations have been formulated. Several committees of the society are now engaged in developing practices on the following subjects: Tool steel; heat treatment of carbon-steel gears; hardness testing of metals; heat treatment of spring steels; heat treatment of spline shafts; testing and inspecting of bolts, nuts, and screws; nitriding; quenching; plastic deformation in pure iron; melting of steel; and hot mechanical working of steel, heat-resisting alloys, pickling of iron and steel, forging of carbon and alloy steels.

American Society for Testing Materials. (See Ch. VIII, p. 286.)

American Specification Institute, Gardner C. Coughlen, acting executive secretary, 205 West Wacker Drive, Chicago, Ill. The prime purpose of this organization, whose members comprise writers of engineering and architectural specifications, is the collection of specifications, information, and ideas from other organizations and sources; the study, discussion, and arrangement of these in standard form; and the distribution of these specifications and information to the members in the form of bulletins and the Institute Specification Record. This latter publication contains specifications, in full or in outline, from

which the specification writer may construct a specification for a particular structure or equipment.

American Standards Association (See Ch. VIII, p. 281.)

American Veneer Package Association, Robert W. Davis, secretary, 900 F Street NW., Washington, D. C. This association cooperates with the transportation companies, shipping associations, and other interested parties in the formulation of standards and strength requirements for shipping boxes and baskets made from veneer. It has committees for standardizing manufacturing procedure and for the study of container problems which work in harmony with the standardization programs of the lumber and allied interests.

American Veterinary Medical Association, Dr. H. Preston Hoskins, secretary-editor, 537 Book Building, Detroit, Mich. During recent years, the association has undertaken three major standardization projects, one of which has been completed. This relates to the establishment of uniform nomenclature of veterinary anatomy. The final report of the special committee appointed for this work was made and published under the title, "Nomina Anatomica Veterinaria." Through the committee on education, the association has been striving for the standardization of the curriculum, as well as the entrance requirements, of the various veterinary colleges throughout the country. The third project is the standardization, as far as possible, of all veterinary biological products. Efforts are being made to bring about more uniformity in nomenclature, methods of preparation, dosage, etc. The special committee on standard milk control code has been cooperating with the United States Public Health Service in an effort to secure approximately uniform milk control practice. The association has recommended the adoption of a standard health certificate to accompany animals being shipped interstate. A movement has been started to secure more uniformity in the State laws regulating the practice of veterinary medicine in the various States.

American Vitrified China Manufacturers Association, E. K. Koos, secretary, care of D. E. McNicol Pottery Co., Clarksburg, W. Va. In cooperation with other units of industry this association was active in the establishment of a limited number of standard sizes and varieties of hotel chinaware, cafeteria and restaurant chinaware, dining-car chinaware, hospital chinaware, and hospital plumbing fixtures, as promulgated in simplified practice recommendations issued by the Bureau of Standards.

American Walnut Manufacturers Association, Burdett Green, secretary-manager, 616 South Michigan Boulevard, Chicago, Ill. The association sponsored the rules for grading American black-walnut lumber, which were published by the National Hardwood Lumber Association in its rules for the measurement and inspection of hardwood lumber, cypress, veneers, thin lumber, and plywood. These grading rules are in general use, not only in the United States, but also in foreign countries. A committee is at work on standard methods of manufacturing and classifying veneers. The association recently formulated specifications for measuring and grading walnut lumber and veneer logs.

American Warehousemen's Association, W. M. O'Keefe, executive secretary, cold-storage division, 222 West Adams Street, Chicago, Ill. This organization sponsored the movement which resulted in the establishment by industry of standard warehouse forms promulgated in a simplified practice recommendation issued by the Bureau of Standards. It also cooperated, through its committee representation, in the standard safety code for mechanical refrigeration established under American Standards Association procedure.

American Water Works Association, Malcolm Pirnie, chairman, committee on water-works practice, 25 West Forty-third Street, New York, N. Y. The committee on water-works practice of this association is preparing material for a second edition of the Manual of Water Works Practice. In it are included specifications for pipe, pipe fittings, meters, and filters. In cooperation with committees of the American Public Health Association and the American Chemical Society, this association is preparing the seventh edition of the book on Standard Methods for the Examination of Water and Sewage. The committee on water-works practice has recently adopted a standard for steel standpipes and elevated tanks which will be presented to the association for consideration at its next annual meeting. The association is joint sponsor for the A. S. A. sectional committees on specifications for cast iron pipe and special castings and on screw threads for fire-hose couplings. It is officially represented (with five other

organizations) on the joint research committee on boiler feed water studies.

American Waxed Paper Association, Paul S. Hanway, manager, 342 Madison Avenue, New York, N. Y. Under the auspices of the division of simplified practice of the Bureau of Standards, this association has sponsored the movement for the establishment of a simplified practice recommendation relating to sizes, weights, and quality of waxed-tissue paper used in wrapping food and other products. The recommendations apply to household rolls, waxed-sheet tissues, butter wraps, and waxed tissues for other specified uses. Methods of packaging by quantities is also recommended in these proposals. Ream sizes are reduced in number.

American Welding Society, M. M. Kelly, secretary, 33 West Thirty-ninth Street, New York, N. Y. Standardization work arising within the welding industry is conducted through technical committees appointed for this society by the American Bureau of Welding, which acts as the research department of the society, and through its committees working in cooperation with committees of other organizations. A revised edition of the bulletin relating to standard welding and cutting nomenclature, definitions, and symbols prepared by a committee of the society is now in the course of preparation. A subcommittee of this committee is likewise engaged in the preparation of a standard welding filing system. A second edition of the code relating to fusion welding and gas cutting in building construction which was issued by the society several years ago, was published in 1930. The committee on building codes has under preparation several sections on welded piping and tankage. It is planning also to compile a code covering electric-resistance welding as applied to the shop fabrication of building parts. The committee on standardization of gages has proposed the adoption of five standard type gages for measuring butt and fillet welds. Several committees of the society are cooperating with the boiler code committee of the American Society of Mechanical Engineers in the promulgation of proper rules and regulations governing the use of welding of unfired pressure vessels and boiler drums. New rules have been issued which divide welding into three classes. A committee is cooperating with the A. S. A. pressure piping committee in the preparation of a welding code for pressure piping. The society has appointed a committee to prepare a code or set of specifications covering the fundamentals of design for conversion of machine-tool electrical equipment and other mechanical parts now made from conventional castings to welded steel. Subcommittees have also been appointed to deal with design and workmanship, gas cutting, and with proper welding materials and permissible unit stresses. The committee on qualification tests for welders is preparing a definite plan for compiling qualification tests which will be published as a preliminary report in order to give the society members an opportunity to suggest changes before the recommendations of the committee are adopted as standard. The society is officially represented on six sectional committees of the American Standards Association. It is also represented on various committees of the American Society for Testing Materials, American Electric Railway Engineering Association, Merchants Association of New York, American Society for Steel Treating, National Research Council, and the National Board of Boiler and Pressure Vessel Inspectors.

American Wood Preservers Association, Horace L. Dawson, secretary, 1427 Eye Street, NW., Washington, D. C. During the past year the association adopted revised standards on definition of creosote, definition of tar, method for the determination of coke residue in creosote oil, method for the determination of the specific gravity of creosote fractions, method for the determination of the specific gravity of creosote oil, method of sampling creosote oil in tank cars, and method for determining the approximate strength of zinc-chloride solution. The association has also adopted standard specifications for zinc chloride, preservative treatment of timber, piles, poles, ties, etc., creosoted wood block paving and flooring, and methods of testing preservative materials.

American Zinc Institute, Julian D. Conover, secretary, 60 East Forty-second Street, New York, N. Y. During the past year the institute inaugurated a campaign to enlarge the use of galvanized sheets by the adoption of a "seal of quality" to be stenciled on sheets of specified weights of zinc coating. All licensed manufacturers whose heavy-coated galvanized roofing sheets comply with the standard thickness of zinc coating or weight recommended by the institute are permitted to use the "seal of quality" on such

products. Sheets bearing the quality label are rigidly tested and inspected to insure standard quality. The institute is joint sponsor, with the American Society for Testing Materials, for the sectional committee on zinc and zinc ores.

Anthracite Institute, Gen. Brice P. Disque, executive director, Edward W. Parker, secretary, 225 South Fifteenth Street, Philadelphia, Pa. The individual anthracite operating companies, comprising the membership of this organization, have largely adopted the uniform classification of accounts and the standard accounting forms approved by the institute. The institute recommended to the industry, in 1929, standard anthracite specifications comprising screen-grading limits for broken, egg, stove, nut, pea, and buckwheat sizes of anthracite, with permissible impurities in each grade. It conducts a laboratory for the approval of coal-using equipment and issues a list of approved devices including domestic stokers, thermostatic equipment, vacuum cleaners, blower systems, service-water heaters, and space heaters. The institute is represented on the A. S. A. sectional committee on classifications of coals.

Arkansas Soft Pine Bureau, Little Rock, Ark. The association has published standard specifications for grades of Arkansas soft-pine lumber, conforming to the American lumber standards for yard and factory lumber. It issues a hand book containing the wood moldings and universal sizes formulated under the auspices of the Central Committee on Lumber Standards. The bureau is conducting a merchandising plan whereby the products of member mills are trade-marked with the bureau's registered symbol, and grade marked in accordance with American lumber standards relating to sizes and grades of softwood lumber.

Aromatic Red-Cedar Closet Lining Association, H. B. Weiss, chairman, care of George C. Brown & Co., Memphis, Tenn. This association cooperated with others interested in the production sale, and use of red-cedar closet lining in the preparation of a commercial standard for aromatic red-cedar closet lining, which covers standard dimensions, heartwood requirements, permissible defects for material, and recommendations for the construction of red-cedar closets. It recommends the use of a label by which the manufacturer guarantees that the material to which the label is attached is in conformity with this standard.

Artistic Lighting Equipment Association, Charles L. Benjamin, managing director, 420 Lexington Avenue, New York, N. Y. The association's standardization committee is continuing its work relative to the standardization of wiring devices for use in the lighting-equipment industry. It is also engaged in standardizing outlet boxes and in formulating standard specifications for architects' use in connection with lighting equipment.

Asbestos Bureau (Inc.), J. W. Clise, jr., secretary, 1061 Sixth Avenue, South, Seattle, Wash. This organization of contractors carries on standardization work in the field of installed heat insulation for piping and boilers in the building industry. It has adopted a standard code covering specifications for the materials and methods of installation for 85 per cent magnesia, high temperature, air cell, wool felt, cork, hair felt, and asbestos-cement installation. It operates a certification system which has met with a very favorable public response, by which the bureau certifies to the building owner that the insulation installed in his building is in accordance with the specifications called for in the building contract, the certificate being accompanied by a bond from a national surety company. The standard code of the asbestos bureau is recommended for insertion in building contracts, but certification of the completed work is not limited to contracts carrying this code.

Ash Handle Association, C. E. Bell, secretary, care of La Fontaine Handle Co., Decatur, Ind. Standard sizes and grade definitions of ash handles established by the industry have been published by the Bureau of Standards in a simplified-practice recommendation. The Ash Handle Association sponsored the movement which resulted in the adoption by industry of the above recommendation. Manufacturers of ash handles for forks, hoes, rakes, and shovels are encouraged to impress the symbol of the grade in the wood of the handle in accordance with the grades specified in the recommendation.

Asphalt Institute, J. E. Pennybacker, managing director, Prevost Hubbard, chemical engineer, 801 Second Avenue, New York, N. Y. For some time past, the institute has been cooperating with the United States Bureau of Public Roads in working out a simplification of existing specifications now in use by the various State highway departments and other public service bodies. The institute's technical committee, composed of technical repre-

sentatives of member companies, has, however, developed and issued during the past year a set of seven simplified specifications covering liquid asphaltic road materials for use in the surface treatment, construction, and maintenance of various types of bituminous wearing courses. In cooperation with the division of simplified practice, the institute assisted in the formulation of the simplified practice recommendation relating to grades of asphaltic products. It is also collaborating with committees of the American Society for Testing Materials on standard tests and specifications for asphaltic products; and with the American Society of Municipal Engineers in the formulation of specifications for the construction of various types of asphalt pavements. The institute is officially represented on the sectional committee on methods of testing road and paving materials functioning under A. S. A. procedure. It maintains a research laboratory for the purpose of carrying on work in the further development of asphaltic products.

Asphalt Shingle and Roofing Institute, J. S. Bryant, manager, 2 West Forty-fifth Street, New York, N. Y. The standardization work of the institute is conducted by its manufacturing and industrial research committee in cooperation with committees of the American Society for Testing Materials, the Underwriters' Laboratories, and the Federal Specifications Board. The institute has adopted granular-metric specifications for red, green, and blue-black slate; methods of test for other raw materials as well as finished-roofing products, including a formula relative to the saturation point of felt used in manufacturing shingles. Its entire membership adopted a resolution whereby it unanimously signified its willingness to certify to purchasers that commodities supplied by them on contracts based on Federal specifications have been tested and found to comply with the requirements of these specifications. The institute maintains two research associates at the Bureau of Standards conducting research on asphalt, asphalt roofing, and durability of felt fibers.

Associated Cooperage Industries of America, Louis F. Horn, secretary, 2008 Railway Exchange Building, St. Louis, Mo. Revised grade rules and specifications for tight barrel staves and heading, and for slack barrel staves, heading and hoops, were adopted by this association in 1931. Standard specifications for steel hoops for tight barrels and kegs were adopted in 1930. This association cooperated with the Bureau of Explosives in the revision of specifications for slack and tight barrels and kegs for the transportation of dangerous articles by rail; these specifications in revised form were adopted by the Interstate Commerce Commission and appear in Dunn's Freight Tariff No. 2, and supplements. The work of cooperation of this association with the Bureau of Explosives and users of barrels is carried on continually. It also cooperates with the Freight Container Bureau of the American Railway Association, and with classification committees, in the promulgation of standard specifications for slack barrels for fruits, potatoes, and other vegetables. Work is now going forward, in cooperation with the Rosin Barrel Manufacturers Association, in the preparation of standards for rosin barrels. The Associated Cooperage Industries of America maintains an inspection service for the inspection of cooperage materials in accordance with the association's standard grade rules and specifications. The association has also adopted standard rules governing sales and settlements. It cooperated with other organizations, under the procedure of the American Standards Association, in the establishment of the standard O 1—1930, for safety code for woodworking plants. At the present time the association is sponsoring a simplified-practice recommendation for standard dimensions of butter tubs. A movement is also in progress for the establishment and acceptance by industry of a classification of tight barrels and kegs, which embodies standards of capacities, dimensions, and grades of materials, as well as including purposes for which each package is suitable. When adopted by the association and accepted by sufficient volume of industry the project will be promulgated as a simplified-practice recommendation by the Bureau of Standards.

Associated Factory Mutual Fire Insurance Companies, C. W. Mowry, Manager, 184 High Street, Boston, Mass. The inspection department of this association of 28 mutual fire-insurance companies serving large industrial plants in the United and Canada, tests electrical equipment and fire-protection equipment and issues lists of "Approved Electrical Apparatus and Fittings" and "Approved Appliances for Fire Protection and Prevention." Manufacturers of approved appliances are permitted to use the association

symbol on devices which have received approval. The inspection department also formulates standard specifications for some of the appliances, writes standard installation rules, and publishes pamphlets giving information on safeguards for special hazards and suggestions of building construction features. This association is a member of the fire-protection group of the American Standards Association and is active in the affairs of the sectional committees of that organization dealing with safety codes and materials and equipment for fire fighting. Through committee representation, the association also cooperates in the standardization activities of the National Fire Protection Association, the American Society of Mechanical Engineers, the American Society for Testing Materials, and other similar organizations.

Associated General Contractors of America (Inc.), Edward J. Harding, managing director, Munsey Building, Washington, D. C. The system of prequalification of prospective bidders on both public and private construction work is promoted by this association which, with other business and professional associations, is now sponsoring the development of a standard bidding and awarding practices code. The association has developed and approved a number of standards, including equipment ownership expense schedule, cost plus a fee contract form, and various estimating forms. It has adopted the American Institute of Architects' form for the construction of buildings and has participated in the development of standard contracts for engineering and municipal construction and in the development of standard questionnaires for bidders and for credit transactions. Through its Mixer Manufacturers Bureau, the association continues to maintain its size and capacity standards for concrete mixers and pavers. The Contractors Pump Manufacturers Bureau of the association has adopted standards for high-pressure pumps and for diaphragm pumps and is working on standards for portable-engine mounted centrifugal pumps. Brass-rating plates are issued by the association for attachment to machines conforming to the association standards. The association has a cooperative program with the manufacturers of hoisting engines concerning the establishment of standards for this type of construction equipment. It maintains representation on seven A. S. A. sectional committees.

Associated Knit Underwear Manufacturers of America, Roy A. Cheney, secretary, Mann Building, Utica, N. Y. This association has adopted a standard method of testing the breaking strength of knitted fabrics and washing instructions for knit rayon underwear and knit wool and wool-cotton underwear. A committee of the association is cooperating with the Federal Specifications Board in developing knit underwear specifications for Government purchases. Two specifications have been developed and are now ready for final action by the board, while six additional specifications have been distributed to Government departments for comment. The association is also cooperating with the Bureau of Aeronautics of the U. S. Navy Department in developing suitable specifications for underwear to be used by aviators for winter flying and for high altitudes. The chief project of the association has been the development of standard sizes, measurements, and methods of measuring for the various types of knit underwear. It cooperated with the division of trade standards of the Bureau of Standards in the establishment of a commercial standard for regain of mercerized cotton yarns, and for boys' blouses, waists, shirts, and junior shirts. At the present time it has 49 standard-size specifications for men's, women's, boys', children's, and infants' knit underwear which, with a few minor changes, have been adopted as commercial standard. The association has adopted a standard mark for use by manufacturers, under license from the association, on garments made to measurements certified to conform to tables appearing in CS33–32. A committee composed of jobbers, retailers, and manufacturers has the right to revoke the license upon proof that the use of the standard mark has been knowingly and wilfully abused. The association has adopted certain symbols for designating different models of knit underwear, and a color code for designating the size of single cotton yarns by the color of cone upon which they are wound, and also has adopted five sizes of boxes as standard for packing all types of men's and boys' knit underwear. The future work of the association consists of a study of the essential characteristics of knitted fabrics such as thermal transmission, air permeability, moisture permeability, water absorption and coefficient of friction.

Associated Manufacturers of Water-Purifying Equipment, Arthur M. Crane,

secretary, P. O. Box 307, Gary, Ind. This organization has adopted standard specifications for pressure water filters covering standard capacities of vertical and horizontal filters, required thickness of shell for various sizes, and working pressures for steel and for cast-iron filters.

Associated Tile Manufacturers, H. L. Gaardsmoe, acting secretary, 420 Lexington Avenue, New York, N. Y. This organization cooperated with the Bureau of Standards in the preparation and revision of the simplified-practice recommendation for clay tiles for floors and walls. It has issued a publication relating to basic specifications for tile work and also one dealing with standard shapes of glazed tiles and trimmers. In assuring the purchasers of uniform quality and grade of tiles, this organization has adopted uniform grade names and a color scheme for grade marking and grade sealing of packages of various types of tiles manufactured to comply with the simplified-practice recommendations relating to this group of commodities. If required in the architect's specification, typical samples of each kind and grade of tiles as specified and proposed to be used, and shop or setting drawings or rubbings, must be submitted to the architect for approval. Each sample must be marked with the name of the manufacturer and the grade of the tile. Approved samples are retained by both the architect and the tile contractor. Before setting any tiles, the tile contractor will furnish to the architect, if specified, a certificate of grade, properly filled in on the form of grade certificate issued by the association. The certificate is signed by the manufacturer of the tiles, states the grade, kind, and full quantities of tiles; and gives identification marks for all packages of tiles furnished under the contract. Packages are branded with corresponding shipping marks, and are grade sealed. They are subject to inspection by the architect or his representative before being opened.

Association of American Feed Control Officials, L. E. Bopst, secretary, College Park, Md. Made up of officials charged with the enforcement of laws regulating the sale of commercial feeding stuffs, this association has as its object the promotion of uniformity in legislation, definitions, and rulings relating to the manufacture, sale, and distribution of feeding stuffs. It has adopted standard definitions of feeding stuffs, which are revised annually. These definitions cover 127 standards and tentative standards. The methods of analysis of the Association of Official Agricultural Chemists have been adopted as the official methods of this association. The regulations of the association require that each package of feed shall bear a complete label giving the net weight, the guaranteed analysis, and all of the ingredients, as well as the name of the manufacturer or jobber supplying the material.

Association of American Soap and Glycerine Producers Inc.), Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. The standardization activities of this organization are conducted by its glycerine group under the direction of the Glycerine Producers' Association, one of the parts of the Association of American Soap and Glycerine Producers (Inc.). (See p. 332.)

Association of American Steel Manufacturers' Technical Committees, J. O. Leech, secretary, 616 Investment Building, Pittsburgh, Pa. Standards adopted by this association include specifications for steel tie plates, allowable variations in size and weight of hot-rolled bars, specifications for rail-steel concrete-reinforcement bars and concrete-reinforcement bars rolled from billets, specifications for structural and boiler steel, standard methods of sampling and permissible variations for check analysis of rolled and forged steel products, specifications for special forging quality bar steel and for commercial quality bar steel, and standard permissible variations in gage weight, gage thickness, size, and flatness of sheets and light plates blue annealed. This association cooperates with the American Society for Testing Materials, the American Standards Association, and other organizations in the establishment of standards for steel products.

Association of American Wood Pulp Importers, G. W. Oliphant, president, 200 Fifth Avenue, New York, N. Y. This association is officially represented, with the American Paper and Pulp Association and the Technical Association of the Pulp and Paper Industry, on a joint committee to approve and govern the actions of commercial chemists engaged in the testing of wood pulp for the paper industry in the United States. Official rules relating to the weighing, sampling, and testing of wood pulp for moisture have been formally approved and adopted by this association. It maintains a traffic committee which cooperates with railroads, steamship companies, and storage warehouses in

the establishment of a standard set of storage and rail freight rates.

Association of Edison Illuminating Companies, Preston S. Millar, secretary, Eightieth Street and East End Avenue, New York, N. Y. This association sponsored the quality improvement program for the purpose of bringing about improvements in the operating characteristics of domestic electrical equipment sold to the public. The work is under the direction of the association's appliance committee which has employed the Electrical Testing Laboratories to serve as its technical agent. In accordance with this program, the qualities of performance of all brands, makes, and models of electrical equipment within each class are determined, and the findings are reported to electric-service companies sponsoring the work for private use in their purchases and promotional activities. Findings are also reported to individual manufacturers, in the case of their own products, and adverse indications are privately discussed with each of them. The committee makes every reasonable effort to cooperate with manufacturers who use the information so supplied in bringing about improvements in their products. In connection with this work the committee has developed proposed safety requirements for customers' electrical equipment and has undertaken a standardization of appliance terminal studs and corresponding attachment plugs for use thereon, and test requirements for electrical insulation in domestic electrical equipment. In addition, it has developed a general and comprehensive outline of tests applicable to any kind of domestic electrical equipment, including flatirons, ranges, toasters, and water heaters. In cooperation with the Illuminating Engineering Society, this association prepared specifications for residence-lighting luminaries. The association is joint sponsor for two A. S. A. sectional committees as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations), and code for electricity meters (with the Bureau of Standards and National Electric Light Association).

Association of Electragists, International, Laurence W. Davis, general manager, 420 Lexington Avenue, New York, N. Y. Believing that a real need existed among electrical contractors, architects, engineers, and building owners for an authoritative guide to best practice in wiring installations, this association's electragists standards committee prepared a report relating to engineering design of residence wiring providing recommendations for adequacy in house wiring for one to four family dwellings. This report was submitted to the association at its 1931 annual convention and was approved for publication and adopted as an additional section of the recommended electragist standards of the association. The association is joint sponsor with the American Institute of Architects and the American Institute of Electrical Engineers for the A. S. A. sectional committee on symbols for electrical equipment of buildings, and is officially represented on five additional sectional committees. As a means toward raising the standards of contractor practices and in order to assist in the promotion of adequate electrical wiring for all uses, the Hudson Valley chapter of this association has inaugurated a certified electrical contractor plan which has been approved and adopted by the A. E. I. In accordance with this plan any electrical contractor may submit his name as a prospective member, provided he is willing to subscribe to the rules contained in the association's code of ethics which are in conformity with those approved by the Federal Trade Commission as a result of a trade-practice conference of the electrical-contracting industry. Among the qualifications considered in accepting or rejecting an applicant, are his financial rating, reputation for paying bills and ability to do good work. Contractors who are qualified to become members are permitted to display the certified electrical contractor emblem. Under this plan each member must submit a report on every new job or complete rewiring job within 10 days of completion. These reports are carefully reviewed and corrections or improvements are suggested to the contractor making the report so that the public may be assured of receiving the full benefit of the service provided for under the plan. The association will temporarily suspend or permanently revoke the indorsement of any certified electrical contractor who has violated any of the rules in connection with this plan.

Association of Governmental Officials in Industry of the United States and Canada, E. Leroy Sweetser, president, care of department of labor and industries, Commonwealth of Massachusetts, Boston, Mass. In cooperation with the Laundryowners National Association of the United States and

Canada, and the National Association of Mutual Casualty Companies, this organization served as sponsor under the procedure of the American Standards Association, for the American tentative standard safety code for laundry machinery and operations. It is officially represented on 16 A. S. A. sectional committees.

Association of Iron and Steel Electrical Engineers, John F. Kelly, managing director, 1010 Empire Building, Pittsburgh, Pa. Standards adopted by this organization include specifications for electric cranes and motors, rules for operation of engine stops, and for operation of cranes, and guide forms for use in ordering large rolling-mill motors and direct-current controllers. A list of standard sizes of roller bearings for mill-type motors has been prepared and is recommended by the association for application to new motors, and work is still in progress on the standardization of roller bearings for old motors. Other work in progress includes the standardization of wiring symbols and markings for magnetic controllers and studies of lubricants and methods, practices, and systems of lubrication. The association is also working on standard methods for comparing fuel efficiency records and standard specifications for ordering reduction-gear sets, gears, and pinions. It cooperated with other organizations, under American Standards Association procedure, in the formulation of the National Electrical Safety Code and the National Safety Code for the Protection of the Heads and Eyes of Industrial Workers.

Association of Manufacturers of Chilled Car Wheels, G. E. Doke, president, McCormick Building, Chicago, Ill. The standards of this association are given in its publication, "Standard Practice for Foundries and Specifications for Tests of Chilled Tread Wheels." These standards, last revised in October, 1930, cover standard foundry practice in the manufacture of chilled tread cast-iron wheels for railway and industrial use, and include requirements on temperature of molten metal, pits, etc., and depth of chill, drop test, and thermal test. This association maintains a corps of inspectors who make semiannual inspections of the member company foundries for the purpose of encouraging and facilitating the use of the association specifications and standards.

Association of Official Agricultural Chemists, W. W. Skinner, secretary, box 290, Pennsylvania Avenue station, Washington, D. C. Standard methods of analysis for agricultural products and other materials used in the agricultural industry which have been formulated and adopted by this association, appear in its publication, Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, the third edition (1930) of which is now being distributed. The methods of physical and chemical analysis cover a wide range of products from the soil and for the soil, including fertilizers, insecticides, beverages, and foods. They are adopted as the standard methods of analysis for many of the specifications of the Federal Specifications Board for agricultural products, and are accepted as authoritative in matters at issue before Federal and State courts. The association cooperates with the American Public Health Association in the preparation of standard methods of milk analysis, and with the committee on revision of the United States Pharmacopœia on methods of testing drugs and medicinal products.

Association of Official Seed Analysts of North America, F. S. Holmes, secretary, College Park, Md. The standards of this association are published by the United States Department of Agriculture as Department Circular 406, entitled "Rules for Seed Testing." These rules cover standard methods of sampling, purity analysis, and germination tests. In cooperation with seedmen's organizations, this association assisted in the preparation of a model uniform State seed bill, and it has consistently recommended that the bill be enacted into the laws of the various States.

Association of Pyroxylin Coated Fabric Manufacturers, C. Stewart Comeaux, secretary, 103 Park Avenue, New York, N. Y. In cooperation with cotton-textile manufacturers, this association has prepared standard specifications for cotton goods used in the manufacture of pyroxylin-coated fabrics.

Association of Railway Electrical Engineers, J. A. Andreucetti, secretary, Chicago & Northwestern Terminal Station, Chicago, Ill. The standards of this association are published in its Manual of Recommended Practice, last revised in 1931. These standards cover the electrical equipment of rolling stock, railway yards, and power plants of steam railways. The association cooperates with other organ-

izations, under American Standards Association procedure, on work which has resulted in the preparation of four standards, and on work still in progress on four other projects.

Automotive Electric Association, Earl Turner, manager, 1365 Ontario Street, Cleveland, Ohio. Recent standardization activities of the association have been devoted to the preparation of commercial recommendations, the collective opinion of the industry's engineers, concerning the type, size, and capacity of generators and storage batteries for the proper illumination and operation of various sizes of motor coaches. Certain portions of the text of these recommendations contain indorsements of standards of the Society of Automotive Engineers. The organization cooperates in S. A. E. standardization activities.

Better Bedding Alliance of America, S. J. Mills, secretary, 608 South Dearborn Street, Chicago, Ill. One of the main activities of this organization is the promotion of State laws and Federal rules and regulations relating to the production and sale of sanitary and honestly labeled bedding materials with compulsory requirements for labeling mattresses and pillows in regard to kind and prior usage of filling materials. It cooperated with other units of industry in the establishment of a limited list of standard sizes of beds, springs, and mattresses as promulgated in simplified-practice recommendation issued by the Bureau of Standards and last revised in 1930. It cooperated with the United States Department of Agriculture in the preparation of the standard United States grades for cotton linter.

Binders Board Manufacturers Association, O. M. Porter, secretary, 122 East Forty-second Street, New York, N. Y. A simplified-practice program initiated by this association resulted in the formulation of the simplified-practice recommendation establishing 10 standard sizes for binders board which have been adopted by both manufacturers and users of this commodity. The association is cooperating with the Bureau of Standards in the preparation of a commercial standard covering minimum specifications for binders board.

Building Officials' Conference of America, John W. Oehmann, secretary, 1253 Lawrence Street NE., Washington, D. C. The primary object of this organization is the discussion of principles and practices underlying the laws and ordinances relating to buildings so far as concerns structural safety, fire hazard, and housing conditions; the methods of administration of such laws and ordinances; and the development and recommendation of regulations and legislation. It does not offer to set up any standards of materials or construction. It cooperates with the Building Code Committee of the United States Department of Commerce in the formulation of standard building codes for adoption by municipalities and States. Through official committee representation this organization has cooperated with other bodies, under the procedure of the American Standards Association, in work which has resulted in the American tentative standard building exits code, and in work still in progress on four other projects.

Bureau of Explosives, Col. B. W. Dunn, chief inspector, 30 Vesey Street, New York, N. Y. The work of this bureau is supervised by an executive committee of railway officials to whom the chief inspector reports periodically. One of the chief functions of this bureau is to revise and keep up to date the Interstate Commerce Commission rules and regulations for the transportation of explosives and other dangerous articles and also specifications for shipping containers. During the past year it revised is pamphlet dealing with drawings and photographs illustrating standard methods for loading and staying carload and less than carload shipments of explosives and other dangerous articles. The bureau's test and specification department cooperates with associations and industries in the investigation of new types of shipping containers and in the development of specifications in detail to cover the manufacture of such containers. The bureau also maintains a chemical laboratory for the study of explosives, other dangerous articles, and containers, and a force of traveling inspectors for the purpose of insuring compliance with the requirements of the regulations and specifications of the Interstate Commerce Commission relating to the transportation of explosives and other dangerous articles.

California Fruit Growers Exchange, F. O. Wallschlaeger, assistant secretary, Los Angeles, Calif. This organization, the owner of two trade-marks for application to fruit, wrappers, or containers, has adopted specifications for the grades of fruit and for methods of packing oranges, lemons, and grapefruit shipped and sold under these trade-marks. The enforcement of grade regulations is lodged with a

field department which has authority to compel repacking and reconditioning of fruit that is not up to grade specifications. Regulations are made regarding the method of application of the trade-marked words and the permissible use of association brands, names, and other wording in connection therewith.

California Redwood Association, J. W. Williams, secretary, 405 Montgomery Street, San Francisco, Calif. Standards adopted by this association include specifications for eastern grades of California redwood lumber which conform to the American Lumber Standards; specifications for western grades of California redwood uppers, sundry commons, and shop; structural grades of California redwood conforming to essential provisions approved by U. S. Forest Products Laboratory, American Railway Engineering Association, American Society for Testing Materials, and California specifications for structural grades of redwood including specifications adopted as standard by the bridge department of California Division of Highways for bridge timbers and for piling. This association is cooperating with manufacturers of other west coast woods on a program for the standardization of patterns and sizes of moldings. It has encouraged the trade and grade marking of redwood lumber in accordance with its specifications, and maintains a department for inspecting redwood lumber and supervising mill grading. Shipments which have been inspected by association inspectors are grade marked and are covered by inspection certificates bearing the official seal and signature of the association.

California White and Sugar Pine Manufacturers Association. (See Western Pine Association, p. 380.)

Canners League of California, Preston McKinney, vice president, 215 Market Street, San Francisco, Calif. Standard grade definitions, including requirements on sugar strength of sirup, for five grades of canned apricots, pears, peaches, sliced peaches, muscat grapes, cherries, plums, one grade of canned prunes, and two grades of fruits for salad have been adopted by the league. The principal standardization project handled by the standards committee of the organization during the past year has been in connection with the formulation of standards by the United States Department of Agriculture under the provisions of the Mapes amendment to the Federal food and drugs act. This amendment provides that canned foods falling below a certain standard, designated by the Secretary of Agriculture, shall bear the label "Below U. S. standard low quality but not illegal." Peaches, pears, cherries, and apricots have been standardized by the Government to date under the above amendment. The league has also adopted standard contract forms for buying and selling fruits and vegetables, payroll forms, pool-car receipts, etc.

Canning Machinery and Supplies Association, S. G. Gorsline, secretary, 549 West Randolph Street, Chicago, Ill. The chief standardizing activities of this association have been those undertaken in cooperation with organizations which make use of the products manufactured by members of the association. In this way it cooperated with the Glass Containers' Association in the standardization of glass containers, and with the National Canners Association in standardizing the sizes of tin cans. It is represented on the A. S. A. sectional committee for tolerances and gages for metal fits, also the committee on standardization of shipping containers.

Cast-Iron Pipe Research Association, Thomas F. Wolfe, research engineer, 122 South Michigan Avenue, Chicago, Ill. This organization is cooperating with the American Standards Association in the preparation of a standard specification for cast-iron pipe and fittings, in the preparation of a code for pressure piping, and in the development of flange standards. The association is represented on the sectional committees working on these various projects. It also cooperates with the American Gas Association in developing mechanical joints for gas pipe and in the preparation of a specification for plain end cast-iron pipe and fittings for use in gas distribution lines. A research associate is maintained at the Bureau of Standards to carry on work in connection with soil corrosion.

Cast Stone Institute, C. G. Walker, assistant secretary, 33 West Grand Avenue, Chicago, Ill. Tentative standard specifications for cast stone covering compressive strength and absorption requirements, and an architectural specification for cast stone for incorporation in construction specifications and covering the physical requirements for the material and rules for installation, have been adopted by the institute.

Central Committee on Lumber Standards. (See Ch. VIII, p. 299.)

Certified Milk Producers Association of America (Inc.), Harris Moak, sec-

retary, 360 Park Place, Brooklyn, N. Y. Standardized methods for the production and distribution of "certified milk" as formulated by the American Association of Medical Milk Commissions have been adopted by this organization.

Chain Institute, Park A. Doing, secretary, 67 Wall Street, New York, N. Y. The committee on simplified specifications of this institute sponsored the movement for the reduction in the number of sizes of chains appearing in manufacturers' catalogues which resulted in the formulation of the simplified-practice recommendation relating to this commodity. The committee is continuing its work in an effort to bring about a further reduction in the sizes of chains now in use.

Chamber of Commerce of the United States of America, E. W. McCullough, manager of department of manufacture; Phillip P. Gott, manager of trade association department, A. B. Barber, manager of transportation and communication department, Washington, D. C. One of the main activities of this organization in the field of standardization is the cooperative and educational service it renders through its large membership and its numerous contacts with business in encouraging the elimination of waste in industry and business. The national chamber also acts as a means for bringing together various groups of industries in an attempt to solve their standardization problems either alone or through the procedure of the various sections of the United States Department of Commerce created for the specific purpose of aiding this type of work.

The chamber, through its department of manufacture, is officially represented on the planning committee which acts in an advisory capacity to the division of simplified practice of the Bureau of Standards. It assisted the movement which resulted in the formulation and acceptance by industry of the simplified practice recommendation for range boilers and expansion tanks, and also cooperated in the adoption of the simplified practice recommendation for standard warehouse forms.

It is cooperating with other organizations, through the National Conference on Street and Highway Safety, of which the manager of the chamber's transportation and communication department is director, in the standardization of street traffic signs, signals, and markings.

The trade association department of the chamber has recently been making a study of trade promotional activities of associations. Included are the activities of some associations with reference to inspecting, certifying, labeling, and guaranteeing the products of their members to be in accordance with standard specifications.

Chlorine Institute, Robert T. Baldwin, secretary, 30 East Forty-second Street, New York, N. Y. Specifications and drawings for standard valves for 100, 105, and 150 pound, and 1-ton chlorine containers have been prepared and adopted by this association. It cooperated with the War Department in formulating standard specifications for liquid chlorine. The institute is still continuing its work in establishing standard procedure for the inspection of transportation containers at liquefaction plants, standard method for the determination of hydrogen in loaded tank cars, and a code of practices governing the handling of liquefied chlorine gas containers of multiple-unit tank cars.

Clay Products Association, George C. D. Lenth, secretary, 111 West Washington Street, Chicago, Ill. This organization is a member of the American Society for Testing Materials, the American Society of Municipal Engineers, and the National Fire Protection Association. It has adopted the A. S. T. M. specifications for clay sewer pipe and for drain tile. It carries on cooperative research on the manufacture and uses of clay products at the University of Illinois and at Iowa State College. Through its committee representation, this association cooperated with other bodies in the formulation of American standard specifications for drain tile, under the procedure of the American Standards Association.

Coal Mining Institute of America, George W. Grove, associate mining engineer, United States Bureau of Mines, Pittsburgh, Pa. The standardization work of this institute is carried on in cooperation with other organizations under the procedure of the American Standards Association. Through its committee representation, it cooperated in the formulation of six American standards and recommended practices, and is at present cooperating in the formulation of a safety code for coal-mine transportation and a standard classification of coals.

Commission on Standardization of Biological Stains, H. J. Conn, chairman, Agricultural Experiment Station, Geneva, N. Y. Certification labels are issued by the commission to manufacturers of biological stains, the cer-

tification label on any bottle of stain meaning that a sample of the particular batch of stain from which the contents of the bottle were taken has been submitted to the commission for testing and a portion is permanently on file in the chairman's office; that the sample proves true to type as judged by spectrophotometric tests; that its dye content is up to specification and is correctly indicated on the label; that it has been tested by experts in the procedures named on the label and has been found satisfactory; and that no other batch can be sold under the same certification number except by such a breach of confidence on the part of the manufacturer as to risk losing the good will of the commission. Up to the present time 50 stains have been put on a certification basis by the commission. This organization cooperated with the Medical Department of the United States Army in the preparation of the recently adopted specifications for eight biological stains. These specifications are to be submitted to the Federal Specifications Board for consideration in the preparation of Federal specifications for these materials.

Common Brick Manufacturers Association of America, Ralph P. Stoddard, secretary, Guarantee Title Building, Cleveland, Ohio. In cooperation with other units of industry the association has been active in the establishment of a limited number of standard sizes of face and common brick as promulgated in a simplified practice recommendation issued by the Bureau of Standards. The association cooperated in the work of the Building Code Committee of the United States Department of Commerce. Recently it prepared suggested specifications for brickwork for incorporation into architect's construction specifications. The association has been active in endeavoring to get its members to produce standard sizes of brick and is publishing a list of its members who have subscribed to the certification plan of the Bureau of Standards or who have had their brick tested and graded according to the association program. Members whose products have been tested and graded in accordance with the above standards are permitted to use the association emblem on their products and in their advertising matter. This association initiated the movement by which the American Standards Association undertook the formulation of a code of good practice for brick masonry, which is nearing completion.

Compressed Air Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. Considerable work has been done by executives and engineers who are associated with member companies of this organization in the formulation of standards for this industry. The association prepared and issued a pamphlet entitled "Trade Standards," in which are included the standards relating to the installation, operation, and care of air compressors and other pertinent data. The fifth edition of this publication, which is now in preparation, will contain a complete revision of the standards of practice for compressor tests, and will have a new section on the testing of vacuum pumps. The society is officially represented on three A. S. A. sectional committees.

Compressed Gas Manufacturers Association (Inc.), Franklin R. Fetherston, secretary, 110 West Fortieth Street, New York, N. Y. Rules for the safe handling and use of compressed-gas cylinders and a schedule of recommended safety devices for use on compressed-gas containers have been formulated by this association. It has also prepared tentative regulations and specifications for the installation and operation of liquefied petroleum-gas storage containers and appurtenant apparatus. The test and specification committee of this association has taken active part in the revision of the Interstate Commerce Commission regulations for the transportation of explosives and other dangerous articles by freight and express, and in baggage service, including specifications for shipping containers. During the past year the valve standardization committee prepared a preliminary report relative to the standardization of gas-cylinder valve outlet threads. For the purpose of selecting suitable standards of design and threads the various gases have been assigned to 10 different classes. The report recommends standards for seven of these classes. This report will form the basis for discussion in the development of national standards under the auspices of the National Screw Thread Commission. The association is officially represented on six A. S. A. sectional committees.

Concrete Products Association, F. O. Matthiessen, secretary, 644 Drexel Building, Philadelphia, Pa. This organization cooperated with other units of industry in the establishment and acceptance of a limited number of standard sizes and varieties of concrete blocks, building tile, and brick,

as promulgated in a simplified practice recommendation for concrete building units. It has a certification plan by which the association issues certificates of quality to those of its members whose products are found to be in accordance with the standards of the American Concrete Institute.

Concrete Reinforcing Steel Institute, M. A. Beeman, secretary, Tribune Tower, Chicago, Ill. The institute cooperated with other units of the industry in the establishment of a limited number of standard sizes and varieties of reinforcing steel and allied commodities as promulgated in simplified practice recommendations on cross-sectional areas of steel reinforcing bars, on sizes of steel reinforcing spiral rods, and on dimensions of forms for concrete joist construction floors. The institute was joint sponsor with the Bureau of Standards, under the American Standards Association procedure, in the establishment of an American standard for steel spiral rods for concrete reinforcement. Other standards of this organization are given in its publication, Reinforced Concrete. This publication contains a code of standard practice for reinforced concrete construction, recommendations on standard methods of design, specifications for reinforced concrete, specifications for placing reinforcing steel, specification for intermediate grade new billet steel bars, recommendations as to standard units of design, and a standard building code for reinforced concrete. This code that was prepared jointly by the American Concrete Institute and the Concrete Reinforcing Steel Institute, appears in the Handbook of Reinforced Concrete Building Design, published jointly by the Concrete Reinforcing Steel Institute, the Portland Cement Association, and the Rail Steel Bar Association. At the instigation of the Concrete Reinforcing Steel Institute, a conference of the reinforcing-steel industry was held about two years ago under the auspices of the Federal Trade Commission. This conference resulted in the adoption of certain rules concerning fair trade practices which are now in effect throughout the industry. Standard weights for reinforcing bars, recently adopted by this institute, correspond to the 11 standard sizes given in simplified practice recommendation R26. The organization is continuing its efforts to standardize on one grade of new billet reinforcing steel, to simplify building codes, to improve the quality of reinforcing steel placing, to develop a quality certification plan for new billet reinforcing steel, and to standardize methods for inspecting new billet reinforcing steel.

Consolidated Freight Classification Committee, R. C. Fyfe, chairman, 404 Chicago Union Station, Chicago, Ill. Consolidated Freight Classification No. 6, with subsequent supplements, is issued by this organization. It contains the official, the southern, and the western classifications of freight. For articles requiring shipment in containers, detail specifications for the containers are included in the rules. Articles packed in containers which do not conform to these specifications may be refused shipment or a higher freight rate may be charged in accordance with standard regulations. The container specifications include requirements on materials, construction, strength of parts, and marking and packing regulations, and cover wooden, metal, paper, and fiberboard containers. Uniform bill-of-lading forms and livestock contracts, as prescribed by the Interstate Commerce Commission, are also included in the regulations.

Contracting Plasterers International Association, Edward McDonnell, secretary, 4755 Commonwealth Avenue, Detroit, Mich. Standard specifications for lathing and plastering which may be incorporated into architects' construction specifications or serve as a guide in writing lathing and plastering specifications have been formulated and adopted by this association. Included in the specifications are recommended practices for various types of lath, plastering, and stucco, with requirements for materials or the citing of standard specifications for materials. The association has also adopted fair-trade practice rules applicable to the construction industry.

Copper and Brass Research Association, William A. Willis, manager, 25 Broadway, New York, N. Y. Standardization work of this association is conducted by its research department through representation on committees of various national organizations interested in the formulation of standards and specifications. It is officially represented on three A. S. A. sectional committees, and cooperates with several technical committees of the Federal Specifications Board in the formulation of specifications for commodities coming within its scope. A research associate is maintained at the Bureau of Standards for investigating the corrosion of copper roofing material.

Cordage Institute, J. S. McDaniel, secretary, 60 East Forty-second Street, New York, N. Y. Several committees of this organization are continuing their cooperative work with similar committees of the American Petroleum Institute in the preparation of standards for cordage used in oil-well production, and with the American Society for Testing Materials in the standardization of methods of tensile-strength testing and nomenclature of all hard-fiber products. Work is now going forward in revising the simplified practice recommendation relating to hard-fiber twines (ply and yarn goods) which was established in cooperation with the National Paper Trade Association and a committee of the institute under the auspices of the division of simplified practice.

Cotton-Textile Institute (Inc.), C. K. Everett, in charge, new uses section, 320 Broadway, New York, N. Y. The work of the institute in simplification and standardization projects is carried on in cooperation with large cloth and yarn consumer organizations, bureaus of the Government and other bodies. In its work on specifications it cooperates with the Bureau of Standards, the American Standards Association, commercial firms and organizations, other trade associations, etc. It is represented on the following standing committees of the Bureau of Standards and the Federal Specifications Board: Standardization and simplification of buffing and polishing wheels; commercial standard for cotton fabric tents, tarpaulins, and covers; and commercial standard for cotton cloth for rubber and pyroxylin coating.

Cover Paper Manufacturers Association, E. H. Naylor, secretary, 95 State Street, Springfield, Mass. In its publication Trade Customs, 1931, are shown the standard sizes and substances adopted by the association for cover paper. Standard ream weights are given for the various sizes and substances and permissible variation from nominal weight in any shipment is specified.

Crown Manufacturers Association of America, Louis B. Montfort, executive secretary, Munsey Building, Washington, D. C. This association of crown or bottle-cap manufacturers has recommended certain standards for the wording and type of label appearing on crowns or bottle caps for beverage bottles. These standards are made to conform to the Federal and State labeling laws on food products and cover the size of type and specific information to be supplied on label, with one general type of labeling for synthetic-flavored beverages, one type of labeling for pure-fruit-flavored beverages, and one type for beverages flavored with the oils of the fruits. This association cooperated with the Glass Container Association, the American Bottlers of Carbonated Beverages, and other units of the industry in the standardization of carbonated beverage bottles as represented in the simplified practice recommendation on this subject now being circulated for acceptance by industry. One of the provisions of this recommendation is that the contents' clause of all beverage bottles be blown plainly and conspicuously in the side of all bottles in the beverage field. By this provision the contents' clause may be omitted from the cap and the same cap may be used for various sizes of bottles.

Dairy and Ice Cream Machinery and Supplies Association (Inc.), Roberts Everett, executive vice president, 225 West Thirty-fourth Street, New York, N. Y. Standardization activities of this association are conducted in cooperation with organizations of allied industries. It cooperated in the establishment of simplified practice recommendations relating to ice cream brick molds and cartons and ice cream cups and cup caps conducted under the auspices of the division of simplified practice of the Bureau of Standards.

Diamond Core Drill Manufacturers Association, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. This association was instrumental in enlisting the services of the Bureau of Standards in the movement which led to the establishment of the commercial standards for diamond-core drill fittings. At the present time a committee of the industry is giving consideration to several changes to be made with respect to a revision of this standard. The association has adopted an emblem to be attached to drill fittings or on packages or cartons containing diamond-core drill fittings to insure users that they are made in conformity with the requirements given in the commercial standard covering this commodity. These emblems are supplied only to manufacturers whose plants are equipped with the necessary gages for producing the diamond-core drill fittings.

Diesel Engine Manufacturers Association, M. J. Reed, research engineer, 30 Church Street, New York, N. Y. After considerable study on the part of executives and engineers associated with companies actively engaged in

the manufacture of oil engines, this association has prepared and issued a booklet in which are set forth several standards dealing with principles of business, practices, selection, and installation of stationary Diesel engines, and definitions. It cooperated with the National Electrical Manufacturers Association in standardizing electric generator sizes and speeds. The association is at present working with other organizations in the formulation of tentative standards for Diesel fuel oils.

Drill and Reamer Society, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. The standing committee on simplification and standardization is still continuing the work of establishing proper standard basic mechanical sizes of drills and reamers to be listed in revised catalogues. The society is officially represented on the A. S. A. sectional committee on allowances and tolerances for cylindrical parts and limit gages.

Eastern Clay Products Association, Henry T. Shelley, secretary-manager, Colonial Building, Philadelphia, Pa. Dimensional standards have been adopted by this association for single strength and for sewer pipe and fittings, pipe traps, slop bowls, stoppers and strainers, flue linings, stove pipe and fittings and chimney tops, wall coping, and liner plates for sewers. It has prepared and recommends a standard specification for the construction of brick chimneys with fireclay flue linings. The quality requirements for clay sewer pipe and drain tile specified in the standard specifications of the American Society for Testing Materials have been adopted by this association. The association has established a laboratory to which member plants may submit specimens of their products to determine whether they conform to standard definite requirements. It holds membership in the American Society of Municipal Engineers, the American Society of Sanitary Engineering, the Association of Highway Officials of North Atlantic States, and the American Society for Testing Materials.

Eastern States Blast Furnace and Coke Oven Association, D. A. Russell, chairman of coke testing committee, care of Youngstown Sheet & Tube Co., Youngstown, Ohio. The standard and tentative standard A. S. T. M. methods of test of coke and bituminous coal have been adopted by this association, which is continuing in cooperative standardization work with the coal and coke testing committee of the A. S. T. M.

Eastern Supply Association, Frank S. Hanley, secretary, 261 Broadway, New York, N. Y. This association has taken an active interest in matters of simplification affecting the industry it represents, having assisted in the formulation of simplified practice recommendations covering plumbing fixtures, range boilers, pipe, valves and fittings, tanks, and traps. It also cooperated in the establishment of the commercial standards for genuine wrought-iron and steel pipe nipples.

Electric Hoist Manufacturers Association, E. Donald Tolles, secretary, 165 Broadway, New York, N. Y. This association formulated and adopted specifications for portable overhead hoists which are in harmony with those of the American Institute of Electrical Engineers, the American Society for Testing Materials, and the National Electrical Manufacturers Association. It is officially represented on the A. S. A. sectional committee on safety code for cranes, derricks, and hoists.

Electric Steel Founders' Research Group, R. A. Bull, director, 541 Diversey Parkway, Chicago, Ill. This group was organized in 1920 to conduct cooperative research work for the improvement, control, and standardization of methods for making small and medium-sized castings of carbon and alloy steels. It cooperated with other units of industry in the establishment and acceptance of a limited number of standard sizes and shapes of foundry refractories, as promulgated in simplified practice recommendation R79–28. Products of the member companies of this organization are subjected to inspection standards adopted by this research group. It has cooperated actively, through its representatives, with the American Society for Testing Materials, the American Foundrymen's Association, the American Institute of Mining and Metallurgical Engineers, the American Society for Steel Treating, and the Sheet Founders' Society of America, in the standardization activities of these bodies. It is officially represented on the joint committee on standardization of foundry equipment and supplies, the joint committee for foundry refractories, and the joint committee on the effect of temperature upon the properties of metals. The research group consistently participates with Government bureaus and with national technical organiza-

tions along lines contributing to the standardization of materials and practices as related to steel casting production.

Electrochemical Society, Dr. Colin G. Fink, secretary, Columbia University, New York, N. Y. The standardization work of this organization, formerly the American Electrochemical Society, is carried on largely by committees appointed to cooperate with other organizations. By this means the society cooperated with the National Electrical Manufacturers Association and the Bureau of Standards in the formulation of standard tests for dry cells used in radio receiving sets. It also cooperated with other organizations, under the procedure of the American Standards Association, on work which resulted in the establishment of the American standard specifications for dry cells and batteries, and on work still in progress on definitons of electrical terms and standard scientific and engineering symbols and abbreviations. Cooperative work is being carried on with the American Society for Testing Materials in determining the resistance to corrosion of various metals and alloys, and cooperative investigations are being conducted with other organizations leading toward standardization of specifications for the electrodeposition of copper, chromium, nickel, zinc, and other metals.

Elevator Manufacturers Association of the United States, John W. Ogren, commissioner, 100 West Monroe Street, Chicago, Ill. This association cooperated with other organizations in the formulation and adoption of the American standard safety code for elevators, dumbwaiters, and escalators under the procedure of the American Standards Association. It is officially represented on sectional committees in the preparation of the safety code for walkway surfaces and the standardization of the speeds of machinery.

Employing Bookbinders of America, Raymond E. Baylis, chairman, standardization committee, 461 Eighth Avenue, New York, N. Y. This organization is cooperating through the Bureau of Standards with the Binders Board Manufacturers Association in an endeavor to standardize binders board with regard to uniform thickness, bursting strength, density, smoothness, etc. Some years ago the Employing Bookbinders of America, in conjunction with the Binders Board Manufacturers Association, simplified the sizes of binders board, adopting 10 sizes which are still being used and considered as standard. The standardization committee has cooperated with the manufacturers of pyroxylin coated fabrics for the bookbinding trade in standardizing the basic grey goods, coating and strength, and has also established classifications of the relative qualities of goods produced by the various manufacturers. The result will be that every piece of goods manufactured and delivered to the industry will be marked clearly and distinctly with a guaranty of the individual member of the association behind its production.

Envelope Manufacturers Association of America, Charles R. Stevenson, secretary-treasurer, 19 West Forty-fourth Street, New York, N. Y. Trade customs which include standard substance number bases for all grades of paper for envelopes, standard nomenclature and sizes of envelopes, and standard tolerances for overruns and underruns on customers' orders, have been adopted by this organization.

Felt Manufacturers Association, M. J. Morrison, secretary-treasurer, 17 Battery Place, New York, N. Y. This association has developed a standard classification of rag stock covering six grades of rags and setting forth the requirements and quality of materials which come under each grade.

Food Service Equipment Association, H. B. Blanke, executive secretary, 10 South LaSalle Street, Chicago, Ill. At its convention in April, 1931, the association approved and adopted a resolution of its committee on standardization and simplification, recommending the establishment under the auspices of the division of simplified practice of the Bureau of Standards of a limited number of standard sizes and varieties of kitchen and restaurant equipment. The recommendations cover standard sizes and thicknesses of various metal sheets, tubing, and pipe, dimensions of sinks, table bases, shelves, pan racks, table bins, table tops, lunch and cafeteria counters, steam tables, etc.

Forging Manufacturers Association, W. J. Parker, commissioner, 7 East Forty-fourth Street, New York, N. Y. This association maintains a specification committee for the purpose of carrying on work dealing with various phases of standardization within the industry. One of the chief functions of this committee is to cooperate with similar committees of other industries in formulating standard designs and specifications for materials best suited to meet particular requirements of

work. It is also engaged in interpreting various specifications which have already been established by users of materials in order to determine standard requirements for certain lines of commodities.

Gas Products Association, Mary Redden, secretary, 250 East Ontario Street, Chicago, Ill. Standard hose connections for welding and cutting torches have been adopted by this association, the International Acetylene Association, and the National Board of Fire Underwriters, and have been approved by the National Screw Thread Commission. These standards cover dimensions and threading of coupling shank for hose, coupling nut, and nipple, and provide right-hand threads for the oxygen connection and left-hand threads for the fuel-gas connection. The association is now engaged in defining existing threads used on oxygen and acetylene cylinder valve outlet connections.

Glass Container Association of America, Victor L. Hall, secretary standardization committee, 19 West Forty-fourth Street, New York, N. Y. Through the work of its standardization committee this association has prepared a book in which are included blue prints covering about 50 different standard types of glass container finishes, which refer to the top of the container on which the closure is applied. The committee is now engaged in developing standard specifications covering outside body dimensions of glass containers. This association has actively cooperated in the establishment of simplified practice recommendations relating to milk and cream bottles and bottle caps; glass containers for mayonnaise, preserves, jellies, and apple butter; carbonated beverage bottles; and cottage cheese and sour cream jars. These recommendations were formulated under the auspices of the division of simplified practice of the Bureau of Standards. The association is conducting research laboratory investigations of various types of glass containers used in the packing of food products.

Glycerine Producers' Association, Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. This organization is a part of the Association of American Soap and Glycerine Producers. Through its glycerine research committee the association cooperates with the Federal Specifications Board and the Bureau of Standards in the formulation and promulgation of specifications for standard grades of refined glycerine. The association permits those members who produce radiator glycerine and follow uniformly the association's formula developed by its research committee and laboratory to sell the product under the grade name "G. P. A. Radiator Glycerine," which is the association's designation for a new grade of glycerine specially developed and manufactured for antifreeze use in automobiles and marketed in containers bearing the association's seal as part of a uniform design. The association's research laboratory tests samples of G. P. A. Radiator Glycerine manufactured by its members to verify compliance by the manufacturers with the association's formula, and in order to assure the public that all products labeled "G. P. A." meet the association's specifications.

Grain and Feed Dealers National Association, Charles Quinn, secretary, Toledo, Ohio. In dealings in grain this association makes use of the grain standards promulgated by the U. S. Department of Agriculture; for dealings in feedstuffs the definitions of the Association of Feed Control Officials of the United States are used. This association has adopted standard trading rules and arbitration rules and a standard form of confirmation blank. The association is a merger of the former Grain Dealers National Association and the United States Feed Distributors Association.

Gray Iron Institute (Inc.), Arthur J. Tuscany, manager, Terminal Tower Building, Cleveland, Ohio. The institute has developed and adopted a standard sales agreement, standard trade customs, and a standard sales contract for transactions in gray iron castings. These standards have been approved by the National Association of Purchasing Agents and the California Chamber of Commerce. They include recommendations for the use of the standard color code for wood patterns established in Commercial Standard CS19–30, issued by the Bureau of Standards. This organization has also developed a standard cost system for gray iron foundries which has been well received by the industry. It is at present working on standard specifications for types of gray iron castings for various services.

Grinding Wheel Manufacturers Association of the United States, Frank R. Henry, secretary, Dayton, Ohio. Acting as joint sponsor with the International Association of Industrial Accident Boards and Commissions, and in cooperation with other organizations, this association formulated the

American standard safety code for the use, care, and protection of abrasive wheels. It is officially represented on the sectional committee dealing with the standardization of speeds of machinery. This association has adopted standard sizes and dimensions for steel center coping wheels, standard sizes of blotters for straight and tapered abrasive wheels, and the standard allowable limits for sizing of aluminum oxide and silicon carbide abrasives for polishing uses and for grinding wheel manufacture as promulgated in Simplified Practice Recommendation R118–30. It initiated the movement that resulted in the recommendation and acceptance by industry of a limited number of types and sizes of grinding wheels, as promulgated in a simplified practice recommendation issued by the Bureau of Standards. The association also took an active part in the subsequent two revisions of the above standard.

Gummed Industries Association, D. A. Crocker, secretary, 370 Lexington Avenue, New York, N. Y. Standardization of No. 1 kraft sealing tape was initiated by this association and led to the acceptance by industry of the simplified practice recommendation on this subject covering standard weights, sizes, and strengths. This standing committee is at present cooperating in a further study of the adhesive qualities of tape with a view to establishing minimum standards at some future time. The association has made arrangements with a commercial testing laboratory whereby acceptors of the simplified practice recommendation may have available a satisfactory means of testing the tape which they manufacture, distribute, or use. Samples are sent to the association where they are given identification numbers and sent to the laboratory for test, the test results being reported to the secretary of the association.

Gypsum Association, Henry J. Schweim, secretary, 211 West Wacker Drive, Chicago, Ill. Much of the standardization work of this association is done in conjunction with the American Society for Testing Materials. The latter organization has adopted standard specifications for gypsum and gypsum products. The association is cooperating in the work of the A. S. A. sectional committee on the preparation of standard plastering specifications, to include gypsum plastering. The association is likewise represented on the A. S. A. sectional committee which formulated the tentative American standard fire tests of building construction and materials. It has recently prepared a section on the use and installation of gypsum for incorporation into the building codes of municipalities.

Hack Saw Manufacturers Association of America (Inc.), W. P. Jeffery, managing director, 14 Wall Street, New York, N. Y. This association cooperated with the division of simplified practice of the Bureau of Standards in the establishment of the recommendation relating to standard sizes of tungsten blades and high-speed blades which have been unanimously accepted by the industry.

Hardwood Interior Trim Manufacturers Association, L. A. Rhodes, assistant secretary, 63 South Third Street, Memphis, Tenn. The 1928 rules and regulations for hardwood interior trim and molding adopted by this association include definition and permissible defects for Grade A trim and molding, with sizes and molding patterns in accordance with American lumber standards as prepared under the auspices of the Central Committee on Lumber Standards. This association cooperated with other organizations, under the procedure of the American Standards Association, in the establishment of the safety code for woodworking plants. It maintains an inspection service which is available to members only for the settlement of disputes regarding species, quality, quantity, or workmanship of lumber sold.

Hardwood Manufacturers Institute, J. H. Townshend, executive vice president, Bank of Commerce Building, Memphis, Tenn. In 1925 this organization adopted the grading rules of the National Hardwood Lumber Association and since that time it has been working with the latter organization in the interest of grade standardization of hardwood lumber. It inaugurated a "car-card plan" by which licensed lumber manufacturers issue car cards guaranteeing the contents of the car to be in compliance with the inspection rules of the National Hardwood Lumber Association.

Heating and Piping Contractors National Association, Joseph C. Fitts, secretary, 50 Union Square, East, New York, N. Y. This association has compiled and published data on computing heat losses, and the selection of the proper boilers. In its book on engineering standards, developed by the committee on standards, there are included rules for determining the amount of radiation required to heat a given space properly; the net square

feet radiation loads recommended for low-pressure heating boilers; pipe sizes for steam heating and hot-water systems; and dimensions of valves and fittings and materials. In promoting its standardization work the association has developed a national program for certified heating to replace the purely local programs formerly in use. It has adopted national insignia, including a certified heating supplementary proposal, to be sent with each bid, the plate to be attached to each boiler, and the certificate to be issued on completion of the work to the house owner, certifying that the heating system was installed in accordance with the certified heating standards adopted by the association. It cooperated with the Bureau of Standards in the establishment of commercial standards for genuine wrought-iron pipe nipples and for standard-weight malleable iron or steel screwed unions, and the simplified-practice recommendation relating to sizes of hacksaw blades. The association is joint sponsor for the A. S. A. sectional committee on pipe flanges and fittings and is officially represented on five additional sectional committees.

Hickory Handle Association, Guy E. Basye, secretary, care of W. E. Bruner & Sons, Heber Springs, Ark. This association cooperated with other representatives of the industry in the formulation and acceptance by industry of standard definitions for various quality grades of hickory handles as promulgated in Simplified Practice Recommendation No. 77, issued by the Bureau of Standards. These standard grades are the recognized standards of this association.

Hollow Metal Manufacturers Association, Charles F. Burt, executive director, Chanin Building, New York, N. Y. This association has worked out the standardization of butt hinges, cylinder locks, and letterbox plates for hollow-metal doors in cooperation with the builders hardware manufacturers and the American Institute of Architects. It also cooperated with the Bureau of Standards in the formulation of simplified practice recommendations relating to kalamein and hollow-metal doors, and in the establishment of commercial standards covering various types of builders' hardware, both template and nontemplate.

Hydraulic Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. In carrying forward its work of standardization in the pump industry, this organization cooperates with the American Society of Mechanical Engineers, American Mining Congress, National Fire Protection Association, U. S. Department of Commerce, and other interested bodies. The society has issued the sixth edition of its publication relating to standards in which are included standard definitions and values; test codes; standard classification of pumps; types, parts, and definitions of reciprocating and rotary displacement pumps, and centrifugal pumps; types, parts, and definitions of deep-well pumps; and instructions for installing and operating various types of pumps. The society is officially represented on four A. S. A. sectional committees.

Illuminating Engineering Society, E. H. Hobbie, general secretary, 29 West Thirty-ninth Street, New York, N. Y. Practically all of the standardization work of this society is conducted under the auspices of the American Standards Association. It is sponsor for the sectional committee on code of lighting factories, mills, and other work places, and joint sponsor with the American Institute of Architects for the code of lighting of school buildings, and with the Society of Automotive Engineers on automobile headlighting laboratory tests for approval of electric headlighting devices for motor vehicles. It is officially represented on seven additional A. S. A. sectional committees.

Industrial Truck Association, C. B. Crockett, secretary, 60 East Forty-second Street, New York, N. Y. This association cooperated with the division of simplified practice of the Bureau of Standards in the formulation of the simplified practice recommendation covering standard clearance dimensions and over-all sizes of skid platforms.

Industrial Unit Heater Association, E. B. Cresap, secretary, 308 West Washington Street, Chicago, Ill. In cooperation with the American Society of Heating and Ventilating Engineers this association prepared and adopted a standard code for testing and rating steam unit heaters applicable to heating equipment in which the heater and radiator are incorporated in one unit and a fan is used to move the air. The code includes methods of testing, layout of test apparatus, and methods of computation.

Insecticide and Disinfectant Manufacturers Association, Harry W. Cole, secretary, P. O. Box 428, Holbrook, Mass. A committee on standardization of nomenclature has been organized by this association to formulate correct definitions of the terms used in

the industry, in order to eliminate the confusion existing by reason of numerous and misleading terms for describing the same material. Its committee on the standardization of insecticides is doing considerable research work on the insect-killing properties of pyrethrum for the purpose of formulating a standard for this type of material. Its committee on the standardization of disinfectants is seeking to standardize the methods of testing germicides and hopes eventually to arrive at a method acceptable to Government, scientific bodies, and manufacturers. Work is being done by other committees on chemical substances used for killing moths, such as paradichlorbenzene, and still other committees are seeking to standardize the regulations pertaining to flash point, combustible substances, and fire hazards in general.

Institute of American Meat Packers, W. W. Woods, president, 506 South Wabash Avenue, Chicago, Ill. In 1928 the institute adopted standards relating to lard cans; sausage, lard, and sliced-bacon cartons; cheesecloth and muslin; wrapping papers of various types; wooden crates and wooden or fiber boxes; pails, tubs, and half barrels; pork barrels, lard and pickled-meat tierces, and curing casks; cleaning and scrubbing brushes and brooms; ropes and twine for tying meats, etc.; and hand trucks and meat trolleys. During the past year standard package sizes have been adopted for sliced dried beef and for vinegar-pickled products in glass jars and revised standards have been adopted for twine and for lard cans. Future standardizing activities will include the standardization of sliced bacon in glass jars. In connection with the standardization of products in glass jars the institute is cooperating with the National Canners Association. It is officially represented on A. S. A. sectional committees dealing with the standardization of speeds of machinery. The research activities of a special committee of the institute culminated in the recent publication of an informative pamphlet entitled "Standard Beef Grading System and Packers' Guide."

Institute of Boiler and Radiator Manufacturers, F. W. Herendeen, secretary, Geneva, N. Y. A standard heating boiler testing code for solid fuel burning low-pressure steam boilers has been formulated by the institute. It has approved the standard ordinance for chimney construction suitable for use in cities and towns, as prepared and recommended by the National Board of Fire Underwriters. Official representation is maintained by this institute on the A. S. M. E. boiler code committee and on the A. S. A. sectional committee which formulated the American standard for pipe threads.

Institute of Makers of Explosives, C. Stewart Comeaux, secretary, 103 Park Avenue, New York, N. Y. One of the chief functions of this institute is the establishment of standard recommended sizes of cartridges and strengths of high explosives. The institute is officially represented on the sectional committee on recommended practice for the use of explosives in bituminous coal mines, which has been approved as an American recommended practice under A. S. A. procedure.

Institute of Manufacturers of Vitreous China Plumbing Fixtures, Wm. Keith McAfee, treasurer, P. O. Box 623, New Castle, Pa. This organization has been cooperating with other members of the sanitary potters industry and with the division of trade standards of the Bureau of Standards in the establishment of a commercial standard, for staple vitreous china plumbing fixtures. Members of this organization serve on the advisory committee for the above commercial standard and are engaged in the standardization of additional details in order to keep the work in step with the progress of the industry. The institute cooperated in the preparation of a commercial standard for colors for sanitary ware, which establishes six definite colors for plumbing fixtures.

Institute of Paint and Varnish Research, Henry A. Gardner, director of laboratory, 2201 New York Avenue, NW., Washington, D. C. This institute represents the American Paint and Varnish Manufacturers Association (Inc.) in cooperating with the Bureau of Standards on research problems, and with the Federal Specifications Board in preparing specifications for paints and varnish. During the past 20 years it has issued over 500 publications relating to its researches, including several volumes, among which is a textbook of methods for the physical and chemical examination of paint products. The methods given in this book have become more or less standard in the industry.

Institute of Radio Engineers, Harold P. Westman, secretary, 33 West Thirty-ninth Street, New York, N. Y.

Since its organization in 1912, this institute has had a committee on standardization whose duty it has been to study and define suitable terms used in radiocommunication, and to propose standard methods of testing and rating radio equipment. Several reports have been prepared by this committee, the last one of which was published in 1931. Included in this latest report are sections dealing with the following subjects: Terms and symbols used in radio; testing and rating of radio transmitters, antennas, and receivers; testing of vacuum tubes; and safety standards dealing with operating personnel in relation to radio transmitting equipment. The institute is a member body of the American Standards Association and is represented on the council of the American Association for the Advancement of Science and Associated Societies. It is also represented on the radio advisory committee of the Bureau of Standards. The institute is joint sponsor with the American Institute of Electrical Engineers for the A. S. A. sectional committee on radio.

Insulated Power Cable Engineers Association, R. J. Wiseman, secretary, care of The Okonite Co., Passaic, N. J. This association acts as an advisory committee to the power cable division of the National Electrical Manufacturers Association and through this channel it cooperates with committees of the American Standards Association and other national standardizing bodies. It has formulated and adopted the following specifications, several in cooperation with the high tension committee of the Association of Edison Illuminating Companies: Specifications for varnished cambric insulated cables; specifications for impregnated paper insulated, lead-covered cables; recommended walls of insulation and of lead sheaths for impregnated paper, lead-covered cables; standard dimensions for reels for impregnated paper, lead-covered cables; color-code scheme for braids for control cables; lead walls for rubber, lead-covered cables; specifications for metallic coverings for power cables; current-carrying capacities for impregnated paper, lead-covered cables; specifications for cable-pulling eyes; recommended walls for rubber cables, test voltages and bending radii; ratio of d. c. to a. c. test voltages for rubber-insulated cables; and specifications for construction of rope or annular core cables.

Intercollegiate Association of Amateur Athletes of America, Gustavus T. Kirby, chairman of advisory committee, 36 East Fifty-seventh Street, New York, N. Y. Standard measurements and rules for competition in running, walking, jumping, pole vaulting, putting the shot, throwing the hammer, throwing of weights, throwing the javelin, and throwing the discus have been adopted by this association and are published in its Official Handbook. In these rules are included standard methods for ascertainment of positions of competitors at the finish and measurement of the time of competition, and also specifications for the various implements.

International Acetylene Association, H. F. Reinhard, Secretary, 30 East Forty-second Street, New York, N. Y. The specifications of the Interstate Commerce Commission for the construction of cylinders used in the transportation of acetylene gas have been adopted by this association. It has prepared and issued a set of standards relating to hose connection on gas regulators and blowpipes or torches. A committee is actively engaged in formulating standards covering connections for hose sizes in excess of three-eighths inch. The association is continuing its cooperation with the Compressed Gas Manufacturers Association in drafting standards for threading of valves used in cylinders for storing compressed gases. It is also represented on four A. S. A. sectional committees.

International Apple Association, R. G. Phillips, secretary, 1108 Mercantile Building, Rochester, N. Y. In years past this organization took an active part in the promotion of legislation for the standardization of fruit and vegetable containers. These activities, cooperated in by other allied trade bodies, resulted in the enactment by Congress of the standard barrel law and the standard basket and hamper acts. The association was instrumental in obtaining the passage of the Federal climax basket act and also the original New York State mandatory standard apple grading law, which was used as a model for the drafting of legislation by other States in the so-called barrel apple territory. It collaborated with other national fruit and vegetable trade organizations, including the National League of Commission Merchants, Western Fruit Jobbers' Association, American Fruit and Vegetable Shippers' Association, and the Fruit and Vegetable Brokers'

Association in drafting and setting up rules and definitions of trade terms for the fruit and vegetable industry, which standards were either approved or adopted by these organizations.

International Association of Blue Print and Allied Industries, Glen Edwards, executive secretary, 431 South Dearborn Street, Chicago, Ill. Committees of this association are working in cooperation with certain departments of the U. S. Government in an attempt to standardize the widths, weights, rag content, and speeds of coated blue-print paper. Standardization of the sizes of photo copy papers is the subject of work by another committee. The association is preparing a standard area chart for the measurement of blue prints.

International Association of Electrical Inspectors, Victor H. Tousley, secretary, 612 North Michigan Avenue, Chicago, Ill. Cooperation in the formulation of standards for the safe installation and use of electrical materials, devices, and appliances is one of the main objects of this association.

International Association of Electrotypers of America, Fred W. Gage, chairman of standardization committee, care of Gage Printing Co. (Ltd.), Battle Creek, Mich. Committees from the American Newspaper Publishers Association and the American Association of Advertising Agencies cooperated with this association in the preparation of standards for printing plates. The standards cover thicknesses and tolerances for unmounted electrotypes and for curved electrotypes, bevel of edges of patent base plates, and standard formula for electrotype backing metal. The association maintains a research associate at the Bureau of Standards for developing improved methods of manufacture of electrotypes.

International Association of Garment Manufacturers, A. F. Allison, 395 Broadway, New York, N. Y. This association cooperated with the Bureau of Standards in the establishment of commercial standards relating to dress patterns; men's pajamas; and boys' blouses, shirts, waists, and junior shirts. It is now assisting the Federal Specifications Board in the preparation of Federal specifications in connection with measurements for dress and work shirts.

International Association of Ice Cream Manufacturers, Fred Rasmussen, executive secretary, Telegraph Building, Harrisburg, Pa. This association has adopted standard sizes, dimensions, and types of ice-cream cans and these standards have been approved by the National Conference on Weights and Measures. It also took a very active part in standardization of sizes and types of ice-cream molds and cartons which resulted in the adoption by this association and by industry of the simplified practice recommendation covering these items. Its simplification committee recommended certain standard sizes and shapes of ice-cream cups, and these standards form the basis of another simplified practice recommendation that is being distributed for acceptance by industry by the Bureau of Standards. Committees of this association cooperated with the International Association of Milk Dealers in the formulation of the standards of the latter association for sanitary pipe fittings.

International Association of Industrial Accident Boards and Commissions, Ethelbert Stewart, secretary, U. S. Bureau of Labor Statistics, Washington, D. C. Standardization activities of this organization relative to industrial safety codes are carried on in cooperation with other organizations under the procedure of the American Standards Association. It acted as joint sponsor on projects resulting in American standards and tentative standards covering the safety code for the use, care, and protection of abrasive wheels; safety code for mechanical power transmission apparatus; safety code for rubber mills and calenders; and safety code for woodworking plants. It is also acting as joint sponsor on work still in progress on the standardization of methods of recording and compiling accident statistics. The association is officially represented on 14 other A. S. A. sectional committees on work which has resulted in American standards and tentative standards, and on 8 committees in which work is still under way. At the annual meeting in October, 1931, the association authorized the appointment of two standing committees—an electrical committee to study problems relating to electrical codes, and another committee to consider codes other than electrical.

International Association of Milk Dealers, R. E. Little, executive secretary, 228 North La Salle Street, Chicago, Ill. For sanitary piping this association has adopted outside diameter measurements for pipe and the acme thread for pipe and fittings as its standards. It has adopted standard dimensions for sanitary pipe fittings which facilitates interchangeability,

standard sizes and dimensions of thermometer spuds for use in coil vats and glass-lined tanks, standard diameters and taper for milk-can necks, and a recent standard on the dimensions of a paper seal sanitary fitting. It initiated the movement which resulted in the establishment and acceptance by industry of simplified sizes and dimensions for milk bottles and bottle caps. The standardization committee of this association is at present working in cooperation with the manufacturers of sheet metal with a view to eliminating some of the defective material furnished in dairy equipment. It assisted the bottle manufacturers, under the auspices of the division of simplified practice of the Bureau of Standards, in the standardization of glass containers for sour cream and cottage cheese.

International Association of Municipal Electricians, W. H. Harth, secretary, City Hall, Columbia, S. C. Standard specifications for underground and aerial cable for fire alarm, police, telegraph, traffic signal, and street-lighting service have been adopted by this association. The specifications cover construction, dimensions, physical and chemical properties of insulation, and electrical tests for rubber-insulated copper wires, copper-covered steel wires, and aerial and underground cables.

International City Managers' Association, Clarence E. Ridley, executive secretary, 923 East Sixtieth Street, Chicago, Ill. This association was represented on a joint committee known as the National Committee on Municipal Reporting, which completed its work early in 1931 with the publication of its report entitled "Public Reporting: With Special Reference to Annual, Departmental, and Current Reports of Municipalities," published by the Municipal Administration Service, New York, N. Y. This publication contains specifications for the preparation of various types of municipal reports. Other organizations cooperating in this project were: The National Municipal League, the Government Research Association, and the American Municipal Association. Within the past year standards for street sanitation and other public-works activities have been established, and several test installations of systems employing these standards in cities of various sizes have been made. This work in the field of street sanitation is being conducted directly under the name of the Committee on Uniform Street Sanitation Records, which represents the International Association of Public Works Officials (formerly the International Association of Street Sanitation Officials), and the following: American Road Builders' Association, American Society of Municipal Engineers, the American Municipal Association, the American Public Health Association, the Governmental Research Association, the International City Managers' Association, the National Municipal League, the American Society of Civil Engineers, and the National Committee on Municipal Standards. The research staff of the International City Managers' Association is working on a standardization program in the field of police records and particularly in this connection has aided the Committee on Uniform Crime Records of the International Association of Chiefs of Police and the United States Department of Justice in expanding and improving the nation-wide system of crime reporting operated by these agencies.

International Society of Master Painters and Decorators (Inc.), E. J. Bush, general secretary, 127 North Jefferson Avenue, Peoria, Ill. Standard colors adopted by this society are published in its color folder and in various sizes of color packs. These standard colors, 43 in number, are designated by number instead of by name in order to avoid the confusion of various shade names. The society cooperated with other units of industry in the establishment and acceptance by industry of the commercial standard for wall paper promulgated by the Bureau of Standards.

Joint Basketball Rules Committee, L. W. St. John, chairman, Ohio State University, Columbus, Ohio; George T. Hepbron, secretary, 105 Nassau Street, New York, N. Y. This committee is made up of representatives of the National Amateur Athletic Union, National Collegiate Athletic Association, National Young Men's Christian Association, National Federation of State High School Athletic Association, National Canadian Amateur Basketball Association, and National Association of Chartered Boards of Officials. It publishes annually a basketball guide containing, among other information, specifications for layout of playing court, and for backboards, baskets, and balls and rules for scoring.

Kraft Institute, Hugh Wright, manager of bag division, 122 East Forty-second Street, New York, N. Y. This organization has taken over the stand-

ardization activities of the former Grocery Bag Manufacturers Service Bureau and the Paper Bag Manufacturers Institute. The standard sizes of paper grocers' bags established by industry and promulgated as a simplified practice recommendation by the Bureau of Standards, have been adopted by the Kraft Institute. In addition it has adopted standard basis weights for the various sizes of grocers' bags. In July, 1931, it adopted standards for odd bags, covering dimensions, basis weights, and packing, and width of roll from which the bag is made. The Kraft Institute has two symbols which the manufacturer may use to label his product, one symbol meaning standard size and the other meaning standard size and standard weight. When variations from the standard marked on the bags are called to the attention of the institute, the manufacturer in question is requested to conform to the standard.

Ladder Manufacturers Association, J. C. A. Leppelman, president, care of Consolidated Pump & Ladder Co., 1608 Tracy Street, East Toledo, Ohio. This association cooperated with other organizations, under the procedure of the American Standards Association, in the establishment of the American tentative standard safety code for the construction, care, and use of ladders, a revision of which was completed in October, 1931. The association permits its licensed member manufacturers to use the association label on all ladders which have been inspected and found to comply with the requirements of the above code as regards safety.

Laundryowners National Association of the United States and Canada, Lloyd A. Peck, general manager, Joliet, Ill. Standard specifications recommended by this association include the chemical composition requirements for 88 per cent soap, soda ash, acetic acid as a laundry sour, and chloride of lime as a bleach. This association publishes a manual of standard practice for the power-laundry washroom which is made up in the form of a text with experimental part for students. It contains recommended standard laundry practice and specifications for soap and bleaching powder. The American Institute of Laundering, controlled and operated by the Laundryowners National Association, maintains the research laboratories for developing and perfecting better laundering methods, for analysis of the cause of damage to damaged articles, and for studying, at the request of manufacturers, the laundering qualities of textiles before they are put on the market. The committee on textile relations of the Laundryowners National Association has proposed the creation of an organization, Integrity in Textiles (Inc.), which would be empowered to license member fabric manufacturers to use a symbol intended as an assurance of fabric quality with the requirement that samples of members' washable products be submitted to washing tests on the basis of 20 cumulative washings before allowing them to be sold under the hall mark. The association was joint sponsor, under the auspices of the American Standards Association, of the safety code for laundry machinery and operations.

Lead Industries Association, F. E. Wormser, secretary, 420 Lexington Avenue, New York, N. Y. The standardizing activities of this organization have been confined to the larger sizes of lead pipe with the purpose of making the recommended working pressures uniform for various pipe diameters. The standardization project is still under way, the procedure being to communicate with the manufacturing members of the association for their views and approval. A report of the results will then be made to the executive committee or board of directors and if there is sufficient unanimity of opinion, the standard will be approved. Manufacturers outside the organization will also be asked to support the standard.

Linoleum and Felt Base Manufacturers Association, Stevenson, Jordan & Harrison, business managers, 19 West Forty-fourth Street, New York, N. Y. Since its organization in the early part of 1931, the association has been carrying on a simplification and standardization program which has resulted in the adoption of maximum permissible number of patterns for a limited list of standard sizes of felt-base rugs and printed-linoleum rugs, maximum permissible number of colors for a limited list of standard thicknesses of linoleums, and standard classification and packing of rugs and linoleums.

Lithographers National Association (Inc.), Maurice Saunders, secretary, 104 Fifth Avenue, New York, N. Y. This organization cooperated in the establishment of, and later accepted the simplified practice recommendation on paper, which established a limited list of standard stock sizes of paper for general printing and publishing,

book publishers' paper, and for forms and letterheads.

Machinery Builders Society, W. C. Fulmer, secretary, 50 Church Street, New York, N. Y. Standardization work of this society is carried on by its several sections. The marine section formulated specifications for bronze propellers which have been approved and adopted by the society. The hydraulic section developed a testing code for hydraulic turbines which formed the basis for the A. S. M. E. code. In addition, the society prepared standard rules of obsolescense covering patterns, jigs, and fixtures; also standard practice of marking patterns.

Malleable Iron Research Institute, Robert E. Belt, secretary, Union Trust Building, Cleveland, Ohio. The official specifications for malleable-iron castings, adopted by this organization for all work other than railroad, conform in all major particulars to specification No. A 47–30 of the American Society for Testing Materials. For railroad work, it has officially adopted specifications requiring castings higher in physical properties than the present specifications of the mechanical division of the American Railway Association. It cooperated in the establishment of the simplified practice recommendation for malleable foundry refractories. One of the main activities of this organization is the certifying of the product of the member companies, certification being made of the product regularly meeting the institute's specifications. Certificates are issued covering a quarter year period and state that the company has daily submitted test bars representative of its product and that the product meets the requirements of the institute for quality. These certificates also permit the manufacturers to use the institute's trade-mark and to advertise their products as having been certified by the institute.

Manganese Track Society, W. Homer Hart, chairman, care of Morden Frog & Crossing Works, Chicago, Ill. The standardization committee of this society collaborated with the track committee of the American Railway Engineering Association in the production of the A. R. E. A. trackwork plans, which include standard designs, constructions, and dimensions with an appendix giving requirements for materials for switches, switch stands, frogs, guard rails, crossings, turnouts, and crossovers. The society was represented on the A. S. A. sectional committee on girder rails and splice bars.

Manufacturers Standardization Society of the Valve and Fittings Industry, Albert C. Taylor, general secretary, 103 Park Avenue, New York, N. Y. During the past year this society issued a revised edition of its standard covering bronze screwed fittings for 125-pound steam pressure. It also prepared and issued a new standard relating to bronze screwed fittings for 250-pound steam pressure. The society cooperated with the Bureau of Standards in the formulation of the simplified practice recommendation dealing with sizes of wrought-iron and wrought-steel pipe, valves, and fittings. It is joint sponsor with the American Society of Mechanical Engineers and the Heating and Piping Contractors' National Association for the A. S. A. sectional committee on pipe flanges and fittings.

Manufacturing Chemists' Association of the United States, Warren N. Watson, secretary, 1121 Woodward Building, Fifteenth and H Streets NW., Washington, D. C. The standardizing activities of this association have resulted in its adoption of standard specifications for graduates, thermometers, chemical laboratory glassware and porcelain ware, and standard density tables for nitric, hydrochloric, and sulphuric acids, ammonia, and zinc chloride. At present it has four technical committees which are doing continuous research work on containers. These committees are the tank car committee, steel barrels and drums committee, carboy committee, and committee on the transportation of poisonous articles and miscellaneous packages. The work of all these committees stresses standardization of chemical containers and the elimination of useless duplication. The carboy committee adopted, in March, 1931, a M. C. A. standard plain type glass-stoppered bottle without blown marks. This includes the 1-pound and the 5-pint C. P. bottle, and blown marks are to be eliminated from all bottles under 5 gallons capacity. Progress has been made, following a thorough investigation last summer, in the specifications for a standard carboy for the chemical industry.

Maple Flooring Manufacturers Association, E. C. Singler, secretary, 332 South Michigan Avenue, Chicago, Ill. This association has established standards of grades and sizes of northern hard maple, beech, and birch flooring. The grade of flooring covers

quality and millwork. The association maintains supervision over the products of its members through regular grade inspection at the mills, and where complaints on such products arise, reinspection service is extended. The right and license to use the MFMA trade-mark is given only to members of the association. They are authorized to issue car cards (furnished by the association) used in certifying as to the contents of the car. The certificates guarantee northern hardwood, correct species, exact size, accurate tally, and standard quality and millwork in each shipment. One of the most recent activities of this association has been the formulation of a standard specification for laying and finishing MFMA northern hard-maple flooring.

Mayonnaise Manufacturers Association, Frank Honicker, executive manager, 1500 Walnut Street, Philadelphia, Pa. This organization sponsored a general conference of the mayonnaise industry in which a simplified-practice program in regard to the sizes of glass containers for mayonnaise, salad dressing, and sandwich spread was recommended for adoption. Through the terms of the proposed recommendation, the number of standard capacities for glass containers is reduced from 25 to 5, with capacity designated according to liquid measure. If accepted by the industry, the recommendation becomes effective on January 1, 1932, for new production.

Mellon Institute of Industrial Research, W. A. Hamor, assistant director, University of Pittsburgh, Pittsburgh, Pa. The institute is a noncommercial establishment, organized for the investigation of problems of technology and for aiding cooperation between science and industry. It operates an industrial fellowship system, the fellowship being donated by an outside individual or organization, the incumbent of the fellowship being engaged by the institute. Some of the research and experimental work carried on at the institute, in collaboration with industrial associations, has resulted in the development of specifications and standards for these organizations. It has cooperated actively with the American Society for Testing Materials, solved problems in testing of containers for the Paperboard Industries Association, made studies pertaining to the devising of washroom formulas and standardization of washroom practice for the Laundry-owners National Association, aided various societies in their textile testing and standardization programs, worked out specifications for cleaners naphtha for the Mundatechnical Society of America, which were later adopted by industry and published as a commercial standard by the Bureau of Standards, and collaborated actively with the American Refractories Institute, and the Magnesia Association of America in their specification and standardization work.

Metalware Institute (Inc.), Warren S. Smith, secretary, 358 Fifth Avenue, New York, N. Y. This organization initiated the movement for the elimination of excess sizes and varieties of sheet-metal ware which resulted in the formulation of the simplified practice recommendation covering sizes of tinware, galvanized and japanned ware. The institute is officially represented on the A. S. A. sectional committee on the safety code for power presses and hand presses.

Milk and Ice Cream Can Institute, D. S. Hunter, commissioner, Keith Building, Cleveland, Ohio. The institute is continuing to carry on standardization activities and it is expected that definite standards of gages and weights will be adopted at an early date. The committee on standardization was appointed by the commissioner at a regular meeting of the institute. The appointees were selected with due regard to the character, size, stability, and geographical location of their businesses, and to the interest and ability of the individual. The committee studies specifications now being used by the various manufacturers and tries to harmonize them so that standards may be obtained with as little subsequent obsolescence of equipment as possible. It has presented two reports, neither of which was entirely satisfactory, but both were of sufficient value to be used as bases for further work.

Millers' National Federation, Herman Steen, secretary, 2719 Board of Trade, Chicago, Ill. The federation has been working for several years on the standardization of flour packages and the differential between packages of various sizes. It has recommended a standard system of accounting which is now being generally used by milling companies. Its uniform sales contract is also largely used by the milling interests. The organization has cooperated with the U. S. Department of Agriculture in the formulation of the latter's definitions and standards for flour, grain, and by-products.

Milling Cutter Society, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. The committee on simplification and standardization is continuing the work of eliminating from catalogue lists, sizes and styles of milling cutters which the trade no longer demands, and is endeavoring to establish proper standard basic mechanical sizes of these tools to be listed in revised catalogues. The society is officially represented on the A. S. A. sectional committee on allowances and tolerances for cylindrical parts and limit gages.

Millwork Institute of California, L. G. Sterett, secretary, 522 Patterson Building, Fulton and Tulare Streets, Fresno, Calif. The standards for millwork, compiled by this organization, are set forth in its publication, Accredited Standards for Architectural Woodwork. The purposes of this publication as stated in the foreword are: First, to create an authoritative and eminent standard quality for all classifications of millwork, defining minimum essentials as to proper materials, sound construction, and uniformly good workmanship; secondly, to inaugurate and maintain a definite guaranty or certification of products manufactured in conformity with the requirements of the established standards. The standards cover interior finish, jambs, jamb and trim assemblies, cabinet work, panelings, cabinets and built-in fixtures, stairwork, doors, windows and sash, blinds and shutters, screens, exterior finish and frames, glass, and glazing. In the license agreement between the institute and a member, the institute agrees to issue a license of "Manufacturer of architectural woodwork" to the member, in which it is stated that all products furnished by the member when stamped, labeled, or branded with the official certificate mark of the institute, must be manufactured in accordance with the accredited standards of architectural woodwork. They are then guaranteed by the Millwork Institute of California. This organization has also formulated a recommended form of millwork specification as a general guide in writing specifications. It is just completing a brochure of architectural frame details containing some 50 half-size and full-size details of window frames for many wall conditions and types of windows. The details are in loose leaf form suitable for drafting room use.

Mine Inspectors Institute of America, C. A. McDowell, secretary, P. O. Box 64, Pittsburgh, Pa. The institute acted as sponsor, under A. S. A. procedure, for the recommended practice for the use of explosives in bituminous coal mines. It is represented on four other A. S. A. sectional committees.

Mirror Manufacturers Association, North Storms, secretary, 2217 Tribune Tower, Chicago, Ill. In cooperation with other units of the industry, this association established the commercial standard CS27–30 for plate-glass mirrors. This standard covers quality requirements for various grades of mirrors and is published by the Bureau of Standards. It has been accepted as the standard of the mirror industry. Many of the mirror manufacturers are now using labels on their products to guarantee the specific article to be in accordance with a specific quality grade as defined in the above standard. In addition the officers of the association have made special efforts toward getting 100 per cent of the association members to express their willingness to furnish mirrors guaranteed by them to comply with the commercial standard. Another project, in furtherance of the quality guarantee principle, is the inspection and resilvering service now being put into effect by the association. Under this service members in one locality will act as agents for members in another locality in handling claims for defective silvering and off-quality mirrors in order that the retail dealer or ultimate consumer may have inspection and resilvering service from a plant close at hand.

National-American Wholesale Lumber Association, W. W. Schupner, secretary, 41 East Forty-second Street, New York, N. Y. This organization took an active part in the standardization program of the Central Committee on Lumber Standards and with the Consulting Committee on Lumber Standards in the establishment of the American lumber standards relating to grades, sizes, and nomenclature of softwood lumber. During the past year it assisted the industry in the application of the certification plan to Federal specifications covering grades of hardwood and softwood lumber.

National Association of Builders Exchanges, Earl F. Stokes, executive secretary, Bond Building, Washington, D. C. One of the main objects of this association is the promotion of uniform building laws throughout the country. It is cooperating with the division of building and housing of the

Bureau of Standards in the formulation of a uniform mechanics' lien law. It has also approved the standard documents of the American Institute of Architects covering the form of agreement and general conditions of the contract, the bond of suretyship, the standard form of agreement between contractor and subcontractor, and the letter of acceptance of subcontractors proposal. It took an active part in the last revision of the above form of bond of suretyship. Among the association's activities in the commodity standardization field is the participation in the establishment and acceptance by industry of various simplified recommendations promulgated by the Bureau of Standards, including partitions for toilets and showers, steel lockers, paint and varnish brushes, forms for concrete floor construction, wheelbarrows, etc. It is cooperating with other organizations, under the procedure of the American Standards Association, in the formulation of a standard recommended practice for brick masonry.

National Association of Building Owners and Managers, Lewis B. Ermeling, executive secretary, 134 South La Salle Street, Chicago, Ill. Standard forms of statement for rental income and expense and for service income and expense have been adopted by this association. It has also adopted a uniform classification of accounts and standard method of accounting for building management. A standard form of office building lease and standard record forms and method of reporting heating records for office buildings have also been adopted. It also has a standard method for floor measurement of rentable areas in office buildings. It cooperated in the formulation of three A. S. A. codes, and is represented on sectional committees for three other projects.

National Association of Dyers and Cleaners of the United States and Canada, Walter H. Franks, acting manager, Silver Spring, Md. This association cooperated with other units of the industry in the establishment of quality standards for Stoddard solvent, published as a commercial standard by the Bureau of Standards, which is cooperating in making a study of the characteristics of dry-cleaning solvents with a view to further standardizing and improving materials and methods of testing materials. The association has laboratories of its own where research work is carried on in the fundamental problems of the dyeing and cleaning industry and where instruction is given to members in the standard practices developed at the laboratories. It issues technical bulletins from time to time on methods and materials developed or tested at its laboratories. Three textbooks on garment cleaning have been published, in which are given standard recommended practices in cleaning of various materials, standard tests for identifying fabrics, standard formulæ for soaps and cleaning compounds, etc. The association has approved the code of business practice of the dyeing and cleaning industry which was adopted at the Washington trade practice conference before the Federal Trade Commission. The code has not yet been finally approved by the Federal Trade Commission.

National Association of Fan Manufacturers, E. B. Cresap, secretary, 308 West Washington Street, Chicago, Ill. This association has adopted a standard method of designating direction of discharge and direction of rotation of centrifugal fans and also standard arrangements of drive for centrifugal fans. In cooperation with the American Society of Heating and Ventilating Engineers it prepared and adopted a standard test code for disk and propeller fans, centrifugal fans, and blowers. Under the auspices of the American Standards Association, representatives of this association are taking an active part in the establishment of American standards for allowances and tolerances for cylindrical parts and limit gages, safety code for conveyors and conveying machinery, and standardization of speeds of machinery.

National Association of Farm Equipment Manufacturers, H. J. Sameit, secretary, 608 South Dearborn Street, Chicago, Ill. Among the standardization activities of this association is the establishment of simplified sizes and varieties of plows and tillage implements. The simplification program was applied not only to plows, but also to stalk cutters, harrows, drills and seeders, cultivators, beet pullers, etc. In addition, this association has adopted specifications and grading rules for wagon stock, including standard dimensions and permissible defects for various wagon parts. It has representatives on four A. S. A. sectional committees. Members of the association, individually, have accomplished much in the direction of intracompany standardization.

National Association of Finishers of Cotton Fabrics, George L. Sawyer, secretary, 40 Worth Street, New York,

N. Y. This association has adopted standard power-laundry washing methods with respect to white goods which are in accordance with the washing methods recommended and approved by the Laundryowners National Association of the United States and Canada. It has also adopted standard methods for testing cotton fabrics to determine their fastness to light and power-laundry washing. In order to protect the public against misleading statements, this association has made arrangements with a commercial testing laboratory to conduct tests of all members' goods to determine the degree of fastness to light and washing. Licensed finishers whose goods receive an "A" or "B" rating for fastness to light and washing are granted the use of the association's "Nafal" label, showing that the particular dyeing from which the sample was taken has passed the requirements and tests of the association's standard for fast colors. The license to use the label is automatically revoked if, by a majority opinion of the executive committee of the association, it has been found that the label was used in a manner contrary to the provisions of the license agreement. The association has adopted a standard method to be employed by the finishers of cotton fabrics for the return by finishers to the converter of all stretched as well as damaged goods, and remnants of finished merchandise over one yard in length. This principle, which has also been adopted by the Textile Converters' Association, has been established as a standard of conduct for the trade. The association is officially represented on two A. S. A. sectional committees.

National Association of Flat Rolled Steel Manufacturers, George H. Charls, president, 511 Terminal Tower Building, Cleveland, Ohio. In cooperation with other organizations, under American Standards Association procedure, this association is assisting in the formulation of standards and specifications for refrigerators and standard specifications for zinc coating of iron and steel. The association also cooperates with groups of fabricators in the establishment of standards for various products made of flat rolled steel. It has adopted the standards of the Association of American Steel Manufacturers for permissible variations in gage weight and thickness, size, and flatness of sheets and light plates. It cooperated with other units of industry in the establishment and acceptance by industry of a simplified list of standard sizes and thicknesses of galvanized flat sheets, cold-rolled box annealed sheets, and blue annealed sheets. It assisted the United States Department of Commerce also in the formulation of model building codes and cooperated with the Bureau of Standards in conducting fire tests on steel garages, steel roofing, and steel office equipment. The trade research division of the association has conducted research relative to the resistance of sheet and strip steel to fire, corrosion, and lightning in farm and industrial buildings, garages, etc.

National Association of Furniture Manufacturers (Inc.), A. P. Haake, managing director, 225 North Michigan Avenue, Chicago, Ill. This association has not yet adopted any standards or specifications, though it is working on simplification and standardization programs through several of its divisions. At present its metal bed and bed-spring division is working on the revision of the simplified practice recommendation on beds, springs, and mattresses. This division also has a special committee working up specifications for a standard quality spring which may carry an association quality label for the purpose of safeguarding the interests of the consumer. The upholsterers' division is working, through the cost accounting department, to set up minimum specifications as to quality of materials used in the manufacture of upholstered furniture. The association is cooperating with the National Cotton Fibers Association (Inc.) to prevent the use of second-hand materials in the manufacture of upholstered furniture, mattresses, and bedding. It also cooperated in the preparation of the commercial standard for plate-glass mirrors.

National Association of Glue Manufacturers, H. B. Sweatt, secretary, 55 West Forty-second Street, New York, N. Y. This association is now promulgating for the industry the specifications relating to standard methods for determining viscosity and jelly strength of glue which were recently revised by its technical division.

National Association of Golf Club Manufacturers, C. B. Johnson, secretary, 900 East Keefe Avenue, Milwaukee, Wis. In cooperation with the Hickory Golf Shaft Association, this association initiated the movement which resulted in the acceptance by the industry of standard quality requirements for hickory golf shafts as embodied in a commercial standard issued by the Bureau of Standards.

National Association of Hosiery and Underwear Manufacturers, Earle Constantine, director, 468 Fourth Avenue, New York, N. Y. This organization has formulated and adopted standards for stainless lubricating oil for knitting machines, percentage of oil on rayon yarn for knitting, lengths of hosiery, hosiery boxes, and method of measuring the size of hosiery. It requested and cooperated in the preparation of the commercial standard for regain of mercerized cotton yarn, promulgated under the auspices of the division of trade standards of the Bureau of Standards. A research associate and his assistant are maintained at the Bureau of Standards for the study of methods of manufacture of hosiery and knit goods; to date, over 4,500 manufacturing problems have been studied and completed. Through this research associate, the bureau is cooperating with the National Association of Hosiery and Underwear Manufacturers in the development of a standard aviator's hose for winter flying, standard lengths for various parts of men's and women's hosiery, and a specification for the wearing quality of hosiery.

National Association of Ice Industries, Leslie C. Smith, secretary, 163 West Washington Street, Chicago, Ill. The movement for the standardization of ice cake sizes, initiated by this association, resulted in the simplified practice recommendation R96. The association also cooperated in the preparation of simplified practice recommendation for ice compartment sizes for domestic refrigerators. It is represented on A. S. A. sectional committees on work which has resulted in the safety code for mechanical refrigeration and standard pipe flanges and flanged fittings. It also has representation on two committees of the American Standards Association in their work on standardizing household refrigerator construction.

National Association of Manufacturers of Heating and Cooking Appliances. Name changed to National Association of Stove Manufacturers. (See p. 347.)

National Association of Marble Dealers, Victor Mosel, secretary, 721 Rockefeller Building, Cleveland, Ohio. A publication entitled "Standard Specifications for Interior Marble Work," has been issued by the association as a guide for the preparation of specifications for interior marble on any particular job. These specifications contain information on standard practice, a list and classification of the most commonly used marbles, and 42 illustrative plates of standard construction methods and details.

National Association of Master Plumbers of the United States, Jere L. Murphy, chairman, standardization committee, 340 East Forty-fourth Street, New York, N. Y. In cooperation with eastern States manufacturers, the standardization committee of this association effected a standardization of copper boilers, connections, and outlets. This committee also prepared standards for connections and dimensions of staple vitreous china plumbing fixtures and for all-clay porcelain plumbing fixtures. The committee is now engaged in standardization work on the following projects: Cast-iron soil pipe and fittings, compression faucets, escutcheons, and connections to plumbing fixtures, enameled iron sanitary ware, flush tank mechanism and flush valves, supply pipes, and traps and water seals to prevent sewer air from entering buildings. The association cooperated with the Building Code Committee of the U. S. Department of Commerce in the revision of the report dealing with recommended minimum requirements for plumbing. It is officially represented on six A. S. A. sectional committees.

National Association of Mopstick Manufacturers, W. A. Babbitt, manager, Box 517, South Bend, Ind. The movement which resulted in the adoption by the mopstick industry of a commercial standard covering dimensions and quality requirements for various types of mopsticks was initiated by this association.

National Association of Motor Bus Operators, John M. Meighan, secretary-manager, 823 Tower Building, Washington, D. C. Uniform practices and standards in the motor bus transportation business were developed by this association, which is actively engaged in the promotion of uniform laws and regulations under which the industry must function. It has adopted as standard practice a "code of principles" covering the basic requisites of a public transportation system as regards safety, reliability, comfort, etc. Its "uniform operating rules" cover actual details of operation of motor buses. It has taken an active part in the work on the National Conference on Street and Highway Safety and the Motor Vehicle Conference. Through its nation-wide collection of information and statistical studies of the bus transportation industry it has been of considerable service to legislative

bodies and other groups in their formulation of laws and regulations. "Bus Facts for 1931" and a "Study of 1930 Motor Bus Operating Costs" comprise the statistical publications of the association for the past year.

National Association of Musical Merchandise Manufacturers, Henry C. Lomb, president, 45 West Forty-fifth Street, New York, N. Y. A standardized nomenclature of banjo parts, specifications for the standard ukulele, and specifications for the standard guitar have been adopted by this association, which is extending its work to include other instruments of the fretted group.

National Association of Mutual Casualty Companies, J. M. Eaton, secretary, 230 North Michigan Avenue, Chicago, Ill. As a member body of the American Standards Association, this organization carried on standardization work which resulted in the formulation of 14 American standard and tentative standard safety codes. The association acted as joint sponsor on the formulation of the safety code for laundry machinery. Work is still going forward on the formulation of five other safety codes.

National Association Practical Refrigerating Engineers, Edward H. Fox, secretary, 435 North Waller Avenue, Chicago, Ill. Although this organization does not inaugurate standardization projects in the refrigeration field, it cooperates in the standardizing activities of other organizations, such as the American Society of Refrigerating Engineers and the American Standards Association. By its representation on sectional committees of the latter body it cooperated in the establishment of the American standard code for mechanical refrigeration, and it is now assisting in the preparation of standard specifications for cast-iron flanged ammonia fittings and a standard code for pressure piping.

National Association of Printing Ink Makers, David H. Sloane, secretary, 1440 Broadway, New York, N. Y. In the report of its standardization committee at the May, 1931, meeting of the association, the general advantages of standardization and the special advantages that might be expected in the printing ink industry were reviewed. The committee divided the field into standardization of product, standardization of materials, standardization of equipment, and performance standardization. It recommended the use of the Munsell system of color for designating the color of inks with shade names as given in a Dictionary of Color by Maerz and Paul. In regard to raw materials, the committee considered only linseed varnishes and dry colors as susceptible to standardization. Favorable replies received from linseed varnish manufacturers indicated their willingness to cooperate in any program relating to the standardization of the viscosities of their products. No recommendations were made in regard to standards for machinery or performance as it was believed preferable to wait until standards had been established in products and materials.

National Association of Purchasing Agents, G. A. Renard, secretary-treasurer, 11 Park Place, New York, N. Y. Standardization and simplification of materials, equipment and supplies in current use by its members constitute important activities of this association. The association participates in the activities of the Central Committee on Lumber Standards, the National Committee on Wood Utilization and the planning committee of the division of simplified practice of the Bureau of Standards. Through its own efforts the association initiated the movement for the reduction of catalogue sizes which resulted in the adoption of the national standard catalogue size. It cooperated with the National Coal Association in the preparation of the standard coal contract form and with the Conveyor Equipment Manufacturers Association in the formulation of standard forms of contract for erected and nonerected conveyor equipment. In cooperation with the Bureau of Standards, it assisted in formulating simplified practice recommendations relating to classification of iron and steel scrap specifications, commercial forms, and paper sizes; also in establishing commercial standards covering various grades and quality of brass pipe nipples and domestic and industrial fuel oils. The coal committee of this association is working with several organizations in connection with the development of the survey on use classification of coal for stationary steam generation of coal sponsored by the International Fuel Conference on Coal. The iron and steel committee developed a standard code for marking steel in bars which has been adopted by both the Federal Standard Stock Catalogue Board and the U. S. Navy Department. The iron and steel committee also assisted in the development of a standard sales agreement and trade customs for the gray-iron foundry industry. This work

was conducted in cooperation with the Gray Iron Institute. The paper shipping containers buyers group of this association is carrying on work in connection with the preparation of specifications for solid fiber containers and for corrugated containers, while the development of standard methods of testing cotton goods is being handled by the cotton fabrics committee. The chemical group is cooperating with the Bureau of Standards in preparing standards of particular interest tothe members of its group. The Electrical Contract Committee in continuing its work, in cooperation with committees of several national electrical organizations, in developing standard electrical contract forms for the purchase of electrical machinery. Several additional committees or groups of this association are still actively engaged on the following projects: Standardization of uniform markings on valves and fittings; simplification of steel filing equipment, with reference to color and size, simplification of laboratory glassware; and standardization of grades and colors of fine office and record papers. During the past year, the executive committee of this association, by formal action, unanimously approved the certification and labeling programs now being developed by the Bureau of Standards. The association is officially represented on five A. S. A. sectional committees.

National Association of Railroad Tie Producers, Roy M. Edmonds, secretary, 1252 Syndicate Trust Building, St. Louis, Mo. This association cooperated with 13 other organizations, under the procedure of the American Standards Association, in the establishment of the American standard specifications for cross ties and switch ties for all classes of use, including mine ties.

National Association of Real Estate Boards, Arthur J. Mertzke, director, Department of Education and Research, 59 East Van Buren Street, Chicago, Ill. Various standard forms, such as appraisal work sheets for various types of property, rental and sales agency contracts, closing sheet, application for real estate loan, extension of lease form, apartment, office, loft, and store lease forms, and management agreement form have been adopted by the association. It has also adopted a code of ethics covering professional relations, relations to clients, customers, and the public. In 1929 the association adopted standards of practice for realtor appraisers and appraisal committees of member boards, covering appraisal of properties exclusive of agricultural, industrial, public utility, mineral, and forest properties. It is cooperating with other organizations in the formulation of a standard recommended practice for brick masonry under the auspices of the American Standards Association. It prepares model appraisal reports to illustrate the procedure in appraising particular types of properties in accordance with its standards of appraisal practice.

National Association of Retail Clothiers and Furnishers, Allen Sinsheimer, executive director, 509 South Franklin Street, Chicago, Ill. Standardization has been an important activity of this association for several years. It cooperated in the establishment of the commercial standard for boys' blouses, button-on waists, shirts, and junior shirts. In addition, it has formulated and adopted standard buying and contract forms and standard store-control methods.

National Coffee Roasters Association, William F. Williamson, secretary, 11 Water Street, New York, N. Y. This association initiated the movement which resulted in the acceptance by industry of the simplified practice recommendation covering sizes and types of 1-pound folding boxes for coffee.

National Association of Safe Manufacturers, R. P. Dryer, secretary, 604 Chester-Ninth Building, Cleveland, Ohio. Although this organization has no specifications of its own it is acting as an agency in harmonizing the specifications for safes of consumer groups and insurance organizations.

National Association of Sheet Metal Contractors of the United States, W. C. Markle, secretary, 429 Fourth Avenue, Pittsburgh, Pa. A 768-page illustrated reference book of standards of practice in fabricating and erecting sheet metal work for the building industry, for the use of architects, engineers, and sheet metal contractors, has been prepared by this association. The association cooperated with other units of industry in the establishment of a simplified list of sizes and varieties of eaves trough and conductor pipe. It is also cooperating with other organizations, under A. S. A. procedure, in the formulation of standard specifications for zinc coating of iron and steel.

National Association of Stove Manufacturers, Kelsey H. Jewett, secretary, Station B, Buffalo, N. Y. The committee on simplified-practice of this association has recommended a definite program by which the individual

manufacturer may eliminate excess varieties and concentrate on the production of three standard types of gas ranges and also standardize the various details of coal and wood stoves and ranges. This committee has also been working with the division of simplified practice of the Bureau of Standards in an attempt to get the whole stove industry to embark on a program of elimination of excess sizes and varieties.

National Association of Waste Material Dealers, Charles M. Haskins, secretary, Times Building, New York, N. Y. In its Blue Book, which is issued every five years for the benefit of its members and of the trade in general, there have been published by this association standards or classifications adopted by other organizations relating to scrap rubber and packing, iron and steel scrap, bagging, rag stock, and nickel and Monel metal. It has established standard classifications for waste materials including metals, rubber, paper, and cotton and woolen rags. Under the auspices of this association functions the National Wiping Cloth Standardization Association with respect to a guarantee plan in connection with quality of wiping cloths. (See p. 365.)

National Association of Wood Turners (Inc.), W. A. Babbitt, secretary, Box 517, South Bend, Ind. In cooperation with the Ash Handle Association and the Hickory Handle Association, this organization initiated the movement which culminated in the establishment and acceptance by industry of standard grade specifications for ash handles and for hickory handles as embodied in the simplified-practice recommendations issued by the Bureau of Standards. In a like manner it cooperated with the National Association of Mopstick Manufacturers in the promotion of standard specifications for mopsticks. These latter specifications have been published as a commercial standard by the Bureau of Standards. The association cooperated in committee work under the auspices of the American Standards Association which resulted in the preparation and adoption by the latter body of the safety code for woodworking plants.

National Association of Wooden Box Manufacturers, R. H. Morehouse, executive secretary, 111 West Washington Street, Chicago, Ill. The Pacific Coast division of this association adopted in 1928 Box Shook Tariff No. 1, which contains specifications for all of the standard fruit and vegetable containers used west of the Rocky Mountains. These specifications are in accordance with State laws regulating packages of this kind and also are in agreement with railroad requirements. They have been of great benefit to shippers as well as to box manufacturers. The main association issues charts giving standard methods of nailing wooden boxes. During the past year it has been working on a manual or ready-reference book for box manufacturers, which will contain recommendations for the construction of boxes and crates as developed from research at the association laboratory as well as information concerning recommendations and tests made by the Forest Products Laboratory of the U. S. Department of Agriculture, the American Railway Association, and other interested bodies. Using these principles of scientific box and crate construction, the association plans to contact various industries, such as canners, washing machine manufacturers, and paint and varnish manufacturers, with a view to designing standard wooden containers, these designs being contingent on the adoption of standard packing specifications by the individual industries. The association has assisted in the preparation of the safety code for woodworking plants under the auspices of the American Standards Association.

National Association of Wool Manufacturers, Walter Humphreys, secretary, 80 Federal Street, Boston, Mass. This association has adopted standard definitions for clean wool, shrinkage of wool, clean content of wool, and normal condition of wool. It cooperates in the standardization activities of the American Society for Testing Materials, and was represented on committees of the American Standards Association on work which resulted in the establishment of the American tentative textile safety code.

National Automobile Chamber of Commerce, Alfred Reeves, general manager, 366 Madison Avenue, New York, N. Y. Practically all standardization work arising in the industry represented by this organization is conducted through the Society of Automotive Engineers. The chamber has, however, cooperated with the National Conference on Street and Highway Safety in the preparation and promulgation of State and city traffic ordinances. It is officially represented on two A. S. A. sectional committees. The chamber, together with the American Petroleum Institute and the

Society of Automotive Engineers, maintains a group of research associates at the Bureau of Standards working on properties and chemical constituents of petroleum products; protective coatings for pipe lines; cooperative fuel research, etc.

National Battery Manufacturers Association, C. M. Angell, chairman, technical committee, care of Vesta Battery Corporation, 6501 West Sixty-fifth Street, Chicago, Ill. Tentative standards adopted by this association include a cold-weather and a room-temperature performance test for the rating of automobile starting batteries; standard dimensions, sizes, and types of push type battery covers, and standard length of battery cells. It has adopted the standards of the Society of Automobile Engineers relating to other dimensions of storage batteries. Work is now going forward on the establishment of standard dimensions for bus and truck batteries. The association is cooperating with other organizations, under American Standards Association procedure, in the formulation of standard definitions of electrical terms.

National Board of Boiler and Pressure Vessel Inspectors, C. O. Myers, secretary-treasurer, 145 North High Street, Columbus, Ohio. The membership of the board is restricted to the chief inspectors or officials charged with the enforcement of inspection regulations by any political subdivisions of the United States that have adopted any of the codes of the American Society of Mechanical Engineers. Unless otherwise exempted, no steam boiler or other pressure vessel built after July 1, 1921, can be used within the jurisidiction of any member of this board, unless it has been distinctly stamped with the ASME symbol and the facsimile approved by the board after having been thoroughly inspected during construction and upon completion by an inspector who has qualified in accordance with the requirements of the board.

National Board of Fire Underwriters, W. E. Mallalieu, general manager, 85 John Street, New York, N. Y. Up to the present time, this organization has issued about 75 publications relating to regulations for the installation of hazardous and protective devices. Of these, the following standard regulations recommended by the National Fire Protection Association were issued in pamphlet form during the past year: National Electrical Code; installation, maintenance, and use of proprietary, auxiliary, and local systems for watchman, fire alarm and supervisory service; central station protective signaling systems for watchman, fire alarm and supervisory service; foam extinguisher systems; installation of sprinkler equipments; water piping systems for outside protection; supervision and care of valves controlling water supplies; construction and protection of piers and wharves; ovens (for japan, enamel, and other flammable finishes); good practice requirements for marine oil terminals; nitrocellulose motion picture film; gas systems for welding and cutting; first-aid fire appliances; installation of pulverized fuel systems; and gravity and pressure tanks. The board has issued the fifth edition of its building code and the fourth edition of its pamphlet on fire-engine tests and fire stream tables. It has also prepared and published recommended safeguards for the coloring of fruits and vegetables. It is a member of the American Standards Association fire protection group, and is joint sponsor with the American Society for Testing Materials and the Bureau of Standards for specifications for fire tests of materials and construction, and with the American Society for Testing Materials for specifications for cotton rubber-lined fire hose for public and private fire department use. The board is joint sponsor for two other A. S. A. sectional committees, as follows: Screw threads for fire-hose couplings (with the American Society of Mechanical Engineers and the American Water Works Association), and insulated wires and cables for other than telephone and telegraph use (with nine other organizations).

National Building Granite Quarries Association (Inc.), H. H. Sherman, secretary, 31 State Street, Boston, Mass. Standard specifications for the erection of architectural granite, for incorporation into construction contracts or specifications, have been adopted by this association. These specifications include general requirements on the quality of the granite and provision for furnishing samples that will show the extreme variation in quality, color, and texture that will occur in any granite supplied. This association has also adopted a uniform proposal form for use by all members in submitting estimates, the use of the form tending to standardize the terms and conditions embodied in the estimates. The uniform contract forms of the association are recommended for use on contracts for granite work.

National Bureau of Casualty and Surety Underwriters, Albert W. Whitney, associate general manager, 1 Park Avenue, New York, N. Y. The major activities of this bureau are of two general types, one pertaining to rates and rating methods, and the other pertaining to the prevention of accidents in private, public, and industrial life. Its major interest in standardization is in its accident prevention work, and centers about the preparation of safety codes. It is a member body of the American Standards Association and is represented on the Standards Council, Safety Code Correlating Committee, and Mining Standardization Correlating Committee, of that body. The bureau is officially represented in the membership of some 40 sectional code committees, and is joint sponsor for the following five projects: Safety code for amusement parks, safety code for conveyors and conveying machinery, safety code for machine tools, safety code for mechanical power-transmission apparatus, and safety code for woodworking plants. The bureau also prepares and publishes occasional booklets on safety standards and standards of safe practice. These include a Handbook of Industrial Safety Standards, A Guide Book for Safety Education, and Safety and Health in Organized Camps.

National Canners Association, Frank E. Gorrell, secretary, 1739 H Street, NW., Washington, D. C. This association maintains research laboratories in Washington, San Francisco, and Seattle, for developing improvements in the canning industry's methods, materials, and products. The results obtained by these laboratories in collaboration with other laboratories of the industry have enabled the association to adopt and publish processes for nonacid canned foods, which are adequate to prevent spoilage and also to conserve the health of consumers. The results obtained in the research laboratories are also made available to the Food and Drug Administration and the Bureau of Agricultural Economics of the U. S. Department of Agriculture, and to the Joint Committee on Definitions and Standards, in order that they may be considered in the formulation of standards for canned foods which are promulgated by those agencies. A committee of the association assisted the division of simplified practice of the Bureau of Standards in formulating a list of 27 sizes of cans for fruits and vegetables, to take the place of the much greater variety of sizes being used. This simplification program was approved at the annual meeting of the National Canners Association in Chicago in 1931, both by the association and by the conference committee representing canners' and distributors' organizations. The final step in the program, that of obtaining acceptances of the program from canners and distributors, is now being completed. A similar program for simplification of cans for canned fish products is contemplated. The association has recommended that contracts for the purchase of canned foods bear notation to the effect that the shipping containers shall be in accordance with standard specifications in the U. S. Food Administration Canned Foods Division Bulletin No. 40, as modified by the association's special container committee at its meeting in 1926. These specifications have been printed and issued as a bulletin of the National Canners Association.

National Coal Association, C. B. Huntress, executive secretary, Southern Building, Fifteenth and H Streets NW., Washington, D. C. As a member body of the American Standards Association, this association cooperates with that organization in the preparation of standards of interest to the bituminous mining industry. It has been or is now officially represented on 12 A. S. A. sectional committees.

National Collegiate Athletic Association, Frank W. Nicolson, secretary, Wesleyan University, Middletown, Conn. As an association of colleges, universities, and institutions of learning the National Collegiate Athletic Association has for one of its objects the stimulation and improvement of intramural and intercollegiate athletic sports. It formulates standard rules of play and establishes standard specifications for balls and equipment used in football, soccer, basket ball, swimming, volley ball, boxing, track, wrestling, hockey, fencing, gymnastics, and lacrosse. The members of the rules committees are nominated by a committee on committees, which in turn is appointed by the executive committee of the association. At the annual convention the list of nominees is submitted and the members of the various rules committees are elected for the ensuing year. These committees are requested, where possible, to cooperate with other national organizations in the publishing of joint rules.

National Committee on Wood Utilization, Axel H. Oxholm, director, U. S.

Department of Commerce Building, Washington, D. C. This committee is composed of 172 members comprising manufacturers, distributors, and consumers of forest products, and representing 78 trade and professional organizations. During the past year it experienced the most active period of its existence. It compiled and issued many publications and pamphlets, including various phases of good practice in wood construction. In carrying forward its slogan, "When you use wood, use it intelligently," the committee made studies regarding the efficient use of wood in building construction; construction, design, and use of furniture; profitable utilization of discarded wooden containers; seasoning, handling, and manufacture of small dimension lumber, with special attention to the standardization of sizes of small dimension stock; economies in the use of treated wood; application and economies of various house insulating materials; and a survey of nonutilized wood in several States. The committee is conducting an educational campaign to encourage the use of grade-marked lumber, which is stamped at the mill with a symbol designating its grade and quality. The development of sources of supply of domestic sawdust and wood flour has also received the attention of the committee. Projects of the committee are promoted by means of educational exhibits, publicity, and through the efforts of its members who make recommendations to the trade groups with which they are affiliated. The recommendations and bulletins of the committee are made available to manufacturers, distributors, and consumers through the active efforts of all cooperating organizations in the forest products industries. The committee cooperates closely with a number of governmental agencies. It is represented on the A. S. A. sectional committee for the preparation of specifications for wood poles.

National Conference on Street and Highway Safety, A. W. Koehler, secretary, 1615 H Street, NW., Washington, D. C. This conference was organized in 1924 by Hon. Herbert Hoover, then Secretary of Commerce, to reduce the heavy toll of accidents in our streets and highways. Its work has developed progressively through extended committee studies and general conferences held in 1924, 1926, and 1930. In this work the conference and its committees have had the constant cooperation of public officials, associations, and individuals from all parts of the country concerned in the problems of motor traffic. The following associations have cooperated with the U. S. Department of Commerce in organizing and financing the conference: American Automobile Association, American Electric Railway Association, American Mutual Alliance, American Railway Association, Chamber of Commerce of the United States, Motor and Equipment Association, National Association of Taxicab Owners, National Automobile Chamber of Commerce, National Bureau of Casualty and Surety Underwriters, National Safety Council, and Rubber Manufacturers Association. In addition, contributions of work and financial support to specific projects were made by the Automobile Club of Southern California, the National Research Council, and the American Engineering Council. The third National Conference held in May, 1930, was attended by delegates from nearly every State in the Union, including official representatives appointed by the governors of 42 States. It reviewed the recommendations of both the previous conferences and of the committees which during the intervening three years had developed reports and as a result presented findings and recommendations, among which were the following: A uniform vehicle code for State enactment comprising a uniform motor vehicle registration act, a uniform motor vehicle antitheft act, a uniform motor vehicle operators' and chauffeurs' license act, and a uniform act regulating traffic on highways; a model municipal traffic ordinance; manual on street traffic signs, signals, and markings; traffic accident statistics; measures for the relief of traffic congestion; protection of railway grade crossings and highway intersections; and maintenance of the motor vehicle. In the above uniform act regulating traffic on highways are included requirements on the equipment to be supplied automobiles and trucks, such as number and illumination efficiency of lamps, provision of and efficiency of horns, mirrors, windshield wipers, brakes, mufflers, etc., limitations on width, height, length, and weight of vehicles, etc. The manual on street traffic signs, signals, and markings give the standards on shape, color, wording, dimensions, construction, and materials of signs and also some structural features, lamp capacities, and color positions for traffic-control signals. Standard usage and design of

street markings are also included in the manual.

National Conference on Weights and Measures, F. S. Holbrook, secretary, Bureau of Standards, Washington, D. C. The conference, sponsored by the Bureau of Standards, is composed of State, county, and city weights and measures officials, and meets annually for the consideration of various problems arising in connection with weights and measures administration, so that uniformity may be promoted among the various jurisdictions and the standard of administrative efficiency be raised. One of the principal activities of the conference is the development of codes of specifications, tolerances, and regulations for commercial weighing and measuring devices, in the initial preparation of which the conference committee on specifications and tolerances and the Bureau of Standards cooperate closely. Twenty-five such codes have been adopted, and one additional code is now in tentative form awaiting final action. As necessity arises, these codes are modified, and new codes are adopted, thus keeping the entire group in line with changing conditions of trade and with the developments of the equipment industry. The conference codes are recommended by the Bureau of Standards for adoption by the States, and these, as well as the reports of the proceedings of each meeting of the conference, are published in the miscellaneous series of the bureau. The conference has also adopted a model State law on weights and measures, and from time to time indorses standard methods of test for commercial apparatus. Manufacturers of weighing and measuring devices and representatives of industries affected by the actions of the conference participate in the conference meetings, and contribute to the discussions leading up to the adoption of the conference codes. The conference has been effective in bringing about a gratifying degree of uniformity and mutual cooperation among the States in the matter of weights and measures supervision.

National Cottonseed Products Association (Inc.), Earle S. Haines, executive secretary, 714 Sterick Building, Memphis, Tenn. The "rules" of this association contain its standards for cottonseed products as last revised in May, 1931. They contain the standard definitions of grade and quality for cottonseed, peanuts, crude and refined cottonseed oil, crude and refined peanut oil, crude soybean oil, crude and refined coconut oil, cottonseed cake and meal, peanut cake and meal, cottonseed hulls, cottonseed linters, soap stock and acidulated soap stock. This association has adopted standard methods of sampling and weighing cottonseed products, and standard methods of chemical analysis of these products. It cooperated with other units of industry in the establishment of a limited number of standard sizes and varieties of packages for vegetable shortening, a simplified practice recommendation which is being circulated by the Bureau of Standards for acceptance by industry. Research work on oils and fats is carried on in cooperation with the Bureau of Chemistry and Soils of the U. S. Department of Agriculture and the formulation of grading rules for cotton linters and cottonseed is carried on in cooperation with the Bureau of Agricultural Economics of the same department. In the formulation of standard trading rules, this association cooperates with the American Feed Manufacturers Association, the New York Produce Exchange, and other produce exchanges.

National Crushed Stone Association, A. T. Goldbeck, director of bureau of engineering, 1735 Fourteenth Street, NW., Washington, D. C. A report on cost accounting, which includes a standard method of cost accounting applicable to the crushed stone industry, was recently completed by this association. An effort is being made within the association to arrive at a set of standard sizes for aggregates, with the cooperation of the National Sand and Gravel Association and the National Slag Association. The organization cooperates with committees of the American Society for Testing Materials and the American Concrete Institute in drawing up standards for methods of testing and for specifications for various types of highway materials which make use of crushed stone. It is also represented in the American Standards Association in connection with the standardization of screen sizes.

National Die and Special Tool Builders Association. (See American Machinery and Tools Institute, p. 306.)

National District Heating Association, D. L. Gaskill, secretary, 603 Broadway, Greenville, Ohio. Standard rules for determining the square feet of radiating surface for steam and hot water heating of buildings have been adopted by this association. It is at present working on a standard

code for pressure piping for district heating piping systems under the auspices of the American Standards Association, and is represented on other A. S. A. committees on the standardization of dimensions and material of wrought-iron and wrought-steel pipe and tubing.

National Door Manufacturers Association, H. L. Stillwell, secretary, Suite 921 Association Building, Chicago, Ill. In cooperation with the Central Committee on Lumber Standards, on which it has permanent representation, this association has adopted a revised "7,000 series" of wood moldings which is nearly ready for distribution to the trade in booklet form. It also has a committee working with the National Hardwood Lumber Association on the formulation of revised hardwood grading rules. In its lists on softwood doors, open sash, and outside blinds are shown cuts, list prices, standard designs and sizes, as well as grading rules defining various grade classifications of these pine products. The association has also adopted and issued printed lists and net extras for hardwood veneered doors, side lights, sash, transoms and K. D. veneered stock; a supplement covering flush door list and net extras is now in process of publication.

National Education Association, J. W. Crabtree, secretary, 1201 Sixteenth Street NW., Washington, D. C. A book entitled "School House Planning," prepared and published by this organization in cooperation with other associations, gives recommendations on the determination of schedule of rooms, choice of general plan, determination of capacity of instruction rooms, library, and study halls, standard illumination requirements, planning and construction requirements to provide safety against fire, general requirements of a construction specification, planning gymnasiums, etc. This association has cooperated with other organizations, under the procedure of the American Standards Association, in the establishment of the American building exits code and the code for the lighting of school buildings.

National Electric Light Association, office of the managing director, 420 Lexington Avenue, New York, N. Y. Included among the active standardizing committees of this association are the following: Accident prevention, electrical apparatus, hydraulic power, meters, inductive coordination, overhead systems, prime movers, and underground systems. Its committee on codes and standards has formulated certain principles and practices in the standardization field which have been issued in pamphlet form. During the past year the association's electrical apparatus committee prepared and issued a report which is intended to serve as an aid in the preparation of purchase specifications covering metal-clad switchgear. Two former publications deal with specifications, namely, guides for specifications covering electrical apparatus and equipment and guides for specifications covering power-station motors and control equipments. This association is joint sponsor for two sectional committees functioning under the rules of procedure of the American Standards Association as follows: Insulated wires and cables for other than telephone and telegraph use and rules for electricity meters (code for electricity meters). As a member of the Electric Light and Power Group in the American Standards Association it is also joint sponsor for a sectional committee on miscellaneous line materials and is represented on 50 sectional committees under other sponsorships.

National Electrical Manufacturers Association, A. W. Berresford, managing director; C. M. Cogan, secretary, standards committee, 420 Lexington Avenue, New York, N. Y. Work in the development of standards in the electrical industry is carried on by this association through the establishment of conference committees cooperating with 52 organizations including technical societies, trade associations; Federal, State, and municipal agencies; foreign bodies; and private industrial concerns. The association is joint sponsor or sole sponsor for 11 sectional committees functioning under the rules of procedure of the American Standards Association. It is joint sponsor with the American Institute of Electrical Engineers for the following six projects: Electric welding apparatus, electrical measuring instruments, industrial-control apparatus, oil-circuit breakers, disconnecting and horn gap switches, power-line insulators for electric power lines, and rotating electrical machinery. It is joint sponsor with the American Society of Mechanical Engineers on frame dimensions of electric motors and specifications for rolled threads for screw shells of electric sockets and lamp bases; with nine other organizations on insulated wires and cables; and with the American Institute of Electrical Engineers and the American Mining Congress on specifi-

cations for trolley, storage battery and combination-type locomotives for coal mines. It is sole sponsor for terminal markings for electrical apparatus. The association has issued, and keeps under constant revision, the following publications covering standards for the manufacture, performance, and test of electrical apparatus and supplies, as well as instructions for their proper installation, operation, and care: Apparatus Standards, Cost Accounting Manual, Electric Shows and Exhibits, Industrial Control Standards, Instructions for Care and Operation of Transformers, Laminated Phenolic Standards, Motor and Generator Standards, National Electrical Code—Its Purposes and Development (1931 edition), NEMA Survey—the house organ, Preferred a. c. Voltage Ratings, Panel Board and Distribution Board Standards, Safety Code for Mechanical Refrigeration, Selection of d. c. Motors for Direct Connection, Supply Standards, Switchgear Standards (1931 edition), Transformer Standards, Uniform Electrical Ordinance, and Vulcanized Fiber Standards. The standards prescribe the minimum data as to ratings, producer, etc., to be carried by name plates or equivalent identifying means. The association recommends that the manufacturer guarantee motors and generators to deliver the rated output indicated on the name plate. The flexible cord group of the association has developed a machine through which a small, flat braceletlike underwriters' label, printed on zinc, in colors which will identify types of cord and which is easily removable by the ultimate purchaser, may be applied to approved forms of cord at intervals of 5 feet. The object is to make approved cord readily identifiable by the inspector, wholesaler, retailer, public utility, and the public at large, even when cut into short lengths for assembly with lamps and other types of cord-equipped electrical appliances. The association is endeavoring to encourage the use of its standards by promoting voluntary acceptance among its member manufacturers for the class of material in which each manufacturer is interested, and to assist in promoting the approval of its standards by the American Standards Association. Approval by the standards committee marks the date on which standards are effective.

National Engineering Inspection Association, Watson Vredenburgh, president, 122 Greenwich Street, New York, N. Y. During the past year this association prepared and published the first edition of its adopted tentative standard methods of procedure relating to the inspection of the following materials used in construction work: Structural steel for buildings and bridges (including mill, shop and field inspection); tee and girder rails and accessories; steel plate pipe; hot-rolled or drawn steel and iron pipe; boiler and firebox steel; cast-iron pipe and specials; cement; concrete; and timber, piles, poles, and ties. Several committees are now carrying on work in the preparation of standard methods of inspection of the following materials: Steel castings, malleable and gray iron castings, steel forgings and axles, steel wheels and tires, and road and waterproofing materials. The association is cooperating with the Concrete Reinforcing Steel Institute in developing standard methods of procedure for inspection of reinforcing steel at rolling mills and reinforcing steel taken from warehouse stock. Through contacts with various Federal, State, and municipal officers, with architects, engineers, and contractors, and through other associations and societies allied with the construction industry, this association is actively promoting the use and adoption of specifications for inspection services.

National Fence Manufacturers Institute, Charles M. Best, secretary, Oliver Building, Pittsburgh, Pa. This organization cooperated in the establishment by industry of a simplified practice recommendation relating to sizes, varieties, and packages of woven wire fencing as promulgated by the Bureau of Standards. It is also cooperating with other organizations, under American Standards Association procedure, in the formulation of standard specifications for zinc coating of iron and steel.

National Fertilizer Association, Charles J. Brand, executive secretary, 616 Investment Building, Washington, D. C. In the furtherance of standardization in fertilizer products this association works in cooperation with Federal and State agencies, agricultural colleges, and experiment stations. It has adopted a uniform terminology for expressing the ingredients for certain fertilizers, such as the use of superphosphate instead of acid phosphate, use of nitrogen instead of ammonia, and a standard order in which the plant food content of a fertilizer is stated. It has been instrumental in securing the adoption in many States of standard lists of fer-

tilizer grades which are recommended both by the official agencies and by the trade for use on various soils and crops. Usually the standard list of grades adopted for a State consists of from half a dozen to a dozen analyses. The work of the association in this field has resulted in the elimination of a large number of unnecessary grades of fertilizer.

National Fire Protection Association, Franklin H. Wentworth, managing director, 60 Batterymarch Street, Boston, Mass. The two main functions of this organization are the making of standards under the guidance of which the fire waste may be checked and the education of the public in the observance of these standards. In its membership are included 135 technical, trade, and insurance associations, and over 4,000 individuals, firms, corporations, and other organizations. Among these member bodies is the National Board of Fire Underwriters, which adopts and promulgates the standard regulations prepared by the 37 representative technical committees of the National Fire Protection Association. These regulations, though purely advisory in character as far as the N. F. P. A. is concerned, are largely enforced by fire departments through city fire prevention codes and by other fire prevention legislation. The association is sponsor or joint sponsor for the following American Standards Association projects: Building exits code, national electrical code, fire fighting equipment in metal mines, safety code for the prevention of dust explosions, insulated wires and cables, rubber lined fire hose, fire tests of materials and construction. It is represented on 18 other A. S. A. committees.

National Founders Association, J. M. Taylor, secretary, 29 South La Salle Street, Chicago, Ill. Standardization of industrial products is outside the scope of this association. It did, however, act as joint sponsor with the American Foundrymen's Association, under the procedure of the American Standards Association, in the establishment of the American tentative standard safety code for the protection of industrial workers in foundries. It has issued a booklet entitled "Minimum Standards of Foundry Apprenticeship" in which are set forth the requirements for thorough apprenticeship training and the necessary steps to be taken in developing a four-year foundry schedule.

National Hair and Jute Felt Manufacturers Association, Allen Bennett Forsberg, managing director, 122 South Michigan Avenue, Chicago, Ill. A set of standards comprising a limited number of standard weights per square yard and loom run widths for hair and jute felts made by the needle loom punching process has been approved by this association which is also working on a standard terminology applicable to the various jute and hair mixes.

National Hardware Association of the United States, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. This organization of wholesale distributors has cooperated with other units of industry in the establishment of a limited number of standard sizes and varieties of sheet steel, flashlight cases, insecticide and fungicide packages, hacksaw blades, shovels, spades, scoops, loaded paper shot shells, terneplate, and eaves trough and conductor pipe, as promulgated in simplified practice recommendations issued by the Bureau of Standards. It initiated the movements which resulted in the formulation of the simplified practice recommendations for the last three of the projects enumerated above.

National Hardwood Lumber Association, L. S. Beale, secretary, 2408 Buckingham Building, Chicago, Ill. One of the principal functions of this organization for the past 33 years has been the maintaining of standards for the grading of hardwood lumber. To take care of the changes occurring in these standards a new edition of the grading rules is issued in January of each year. The grading rules cover the measurement, inspection, and grade definitions of hardwood lumber, cypress, veneers, thin lumber, and wagon stock. They are now practically accepted throughout the world as standards for the grading of hardwood lumber. Bonded inspectors are maintained by this association in the principal producing and consuming centers of the country for the purpose of inspecting lumber shipments and issuing certificates guaranteeing the grade of the lumber. The organization cooperated with other organizations in the preparation of specifications for cross ties and switch ties under the auspices of the American Standards Association. It is represented on an A. S. A. sectional committee in the preparation of standard methods of testing wood.

National Hay Association (Inc.), Fred K. Sale, secretary-treasurer, 600 Board of Trade, Indianapolis, Ind. Standard definitions of grades of various varieties of baled hay and straw,

formulated and adopted by this association, have been adopted by 34 hay exchanges and associations throughout the country. These grades form the basis also for the specifications for hay and straw that are promulgated by the Federal Specifications Board. This association will examine any inspector being employed by an organization using the association rules, upon request by that organization. If found qualified, the inspector is approved by the association. One of his duties is to attend the annual meeting of the association and provide an exhibit of those grades of hay generally handled at his market; these samples together with samples furnished by other inspectors are used for comparison of application and interpretation of the grade rules by the different inspectors and members of the association.

National Jewelers Board of Trade, B. L. Shinn, secretary, 22 West Forty-eighth Street, New York, N. Y. In order that there may be uniformity throughout the trade with respect to certain articles of jewelry, this board has formulated standard recommended practices covering descriptions of diamonds, precious stones, pearls, and their imitations. At a trade practice conference held in 1929 under the auspices of the Federal Trade Commission, these recommendations were finally adopted as standards for the trade.

National Lightning Rod Manufacturers Association, E. R. Stotts, general manager, care of Dodd & Struthers, Des Moines, Iowa. Standards of this association are incorporated in the Code for Protection Against Lightning published by the Buerau of Standards. This code was the result of the cooperative work of several organizations including the National Lightning Rod Manufacturers Association, working under the sponsorship of the American Institute of Electrical Engineers and the Bureau of Standards, and carried out under the procedure of the American Standards Association. The code includes specifications for lightning rods and rules for their installation along with regulations for the protection of buildings, towers, smoke stacks, etc., and for the protection of structures containing inflammable liquids and gases. Other work of this association includes that done in cooperation with the Farm Fire Protection Committee of the National Fire Protection Association in the effort to keep the standards of the two organizations in harmony.

National Lime Association, Norman G. Hough, president and general manager, 927 Fifteenth Street NW., Washington, D. C. An organization of leading lime manufacturers formed to encourage a better appreciation of the economic value of lime in all its uses, the association has issued a series of brochures covering the uses of lime in various manufacturing processes and has included in them the recommended general requirements or specifications for the lime entering into the various specific processes. The organization has adopted specifications for the lime treatment of earth roads; it has issued proposed specifications for lime stucco and lime plastering, and has promulgated standard formulas for whitewash and cold-water paints. It has issued recommended practices in the use of lime in lime mortar and lime-cement mortar and has formulated specifications for the uses of lime in asphalt for paving purposes and in concrete pavements. It is cooperating with the Building Code Committee of the U. S. Department of Commerce, the National Board of Fire Underwriters, and the larger cities of the country in a revision of building codes, and is also cooperating with the Association of Official Agricultural Chemists in the formulation of standard definitions for the several terms used in connection with the use of lime in agriculture. The association is a member of the American Concrete Institute, and is cooperating with that organization in research and investigations relative to the use of lime in concrete. It maintains membership in the American Society of Municipal Engineers, and its representatives are active in the affairs of the latter society in developing a standard method and process involving the use of lime in the clarification and purification of public water supplies and in the disposal and purification of sanitary wastes.

National Luggage and Leather Goods Manufacturers Association, oJhn B. McEwan, executive secretary, 30 North La Salle Street, Chicago, Ill. The committee of simplification of this association formulated a tentative recommendation for the simplification of sizes of ladies' suitcases and trunks, which was made the subject for consideration at a general conference on May 11, 1931, of manufacturers, dealers, and users held under the auspices of the division of simplified practice of the Bureau of Standards. As a result of this conference, it is expected that a simplified practice recommendation establishing a limited list of standard sizes and dimensions

for women's suitcases and wardrobe trunks will be accepted by the industry and promulgated by the Bureau of Standards.

National Luggage Dealers Association, A. B. Sheldon, secretary, 241 Genessee Street, Utica, N. Y. Standardization of trunks and suitcases has been an important activity of this association. It initiated the project for the adoption of a limited number of standard sizes and types of ladies' suitcases which formed the basis of a simplified practice recommendation now being circulated for acceptance by industry. It also cooperated in the formulation of a simplified practice recommendation for wardrobe trunks which is also in the process of acceptance.

National Lumber Manufacturers Association, Wilson Compton, secretary-manager, Transportation Building, Washington, D. C. The activities of the association are largely limited to problems of national scope, and in dealing with such problems it represents, in a national way, its affiliated regional associations—the California Redwood Association, Hardwood Manufacturers Institute, North Carolina Pine Association, Northern Hemlock and Hardwood Manufacturers Association, Southern Cypress Manufacturers Association, Southern Pine Association, West Coast Lumbermen's Association, Western Pine Association, and, in addition, individual manufacturers of northern pine and eastern spruce. It takes a leading part in the activities of the Central Committee on Lumber Standards and the Consulting Committee on Lumber Standards, and is represented on the Hardwood Consulting Committee which cooperated with the Central Committee on Lumber Standards in the formulation of the American standard basic provisions for hardwood lumber. Through committee representation the association is assisting in the standardization work of some 40 national and regional organizations. It maintains representation on 13 A. S. A. sectional committees. In cooperation with other branches of the lumber industry, architects, and millwork manufacturers, this association has developed standard designs for wood moldings, which are now in the process of printing. The association licenses the use of its "treemark" on lumber in conjunction with the grade mark, trade-mark, or species mark of licensed mills that conform to American lumber standards, the lumber being guaranteed by the National Lumber Manufacturers Association to the first unloading buyer to conform to such specifications as may be indicated thereon. During the past few years the association has carried on work in connection with the development of standard construction methods as related to wood construction and has published pamphlets on heavy timber mill construction details, house framing details, and maximum spans for joists and rafters. It cooperated with other units of industry in the establishment and acceptance by industry of commercial standards for grades for hickory golf shafts, aromatic red-cedar closet lining, red-cedar shingles, and plywood, under the auspices of the Bureau of Standards.

National Macaroni Manufacturers Association, B. R. Jacobs, Washington representative, 2026 Eye Street NW., Washington, D. C. Definitions and standards promulgated by the U. S. Department of Agriculture for use in the enforcement of the Federal food and drugs act have been adopted and used by this association as standards for its finished products and raw materials. These definitions cover alimentary pastes, noodles, macaroni, spaghetti, vermicelli, purified middlings, semolina, and farina. This association has given cooperative assistance to the Federal Specifications Board in the latter's preparation of specifications for macaroni products. It has recently committed itself to the promotion of legislation on macaroni products similar to the recent Mapes amendment to the Federal food and drugs act covering canned foods.

National Machine Tool Builders' Association, Ernest F. DuBrul, general manager, 617 Vine Street, Cincinnati, Ohio. This organization is joint sponsor with the American Society of Mechanical Engineers and the Society of Automotive Engineers, under the auspices of the American Standards Association, for all projects covering standards for small tools and machine tool elements. It has been instrumental in preparing American standards and tentative standards for T slots; their bolts, nuts, tongues, and cutters; tool holder shanks and tool post openings; milling cutters, and cut and ground thread taps. Work is now under way on standards for various parts of machine tools. The association was represented on sectional committees which prepared American standards for screw threads for bolts, machine screws, nuts and tapped holes, standards for ball and roller bearings, safety code for the use, care and pro-

tection of abrasive wheels, safety code for power presses and foot and hand presses, standards for small rivets, wrench head bolts and nuts and wrench openings, slotted head proportions, track bolts and nuts, round unslotted head bolts, plow bolts, tinners', coopers', and belt rivets. On other sectional committees on which this organization is represented, work is now going forward on the standardization of speeds of machinery, standard mounting dimensions for electric motors, standard drafting-room practice, and standards for charts and graphs.

National Metal Exchange (Inc.), J. J. Murphy, assistant secretary, 27 William Street, New York, N. Y. Among the objects for which this organization was created were the provision, regulation, and maintenance of an exchange for dealing in tin, copper, and silver futures, and the maintenance of uniformity in rules, regulations, and usages in the business. Committees on tin, copper, and silver are appointed annually by the board of governors of the exchange. Their duties include the reporting and the recommending to the board of governors of changes in and additions to the by-laws and rules regulating trading in their respective spheres. The exchange has adopted standard contract forms for transactions in tin, copper, and silver. Its by-laws include lists of grades of tin, copper, and silver which are tenderable on the standard contracts. It specifies the standard of pure metal content which each grade must maintain in order to be kept on the official list of tenderable grades and brands.

National Municipal League, Russell Forbes, secretary, 261 Broadway, New York, N. Y. Model laws are devised, published, and distributed by this organization and are intended to serve as standards and to stimulate uniformity in State, county, and city legislation. They include a model bond law, budget law, city charter, county manager law, election administration system, registration system, and model State constitution. At present, a committee is at work devising a model administrative code to accompany the model city charter as the basis for legislation to inaugurate the city manager plan of government. The organization of two important joint committees was initiated by this league. They are the National Committee on Municipal Standards and the National Committee on Municipal Reporting and are made up of representatives of the National Municipal League, the Governmental Research Association, and the International City Managers Association, the latter of the two committees having representatives also of the American Municipal Association. The National Committee on Municipal Standards acts as an advisory body, the work being carried on by the International City Managers' Association which is at present engaged in installing standard accounting and reporting forms in various cities for measuring the results of street sanitation. The National Committee on Municipal Reporting recently issued its first report entitled "Public Reporting." This report is really a set of specifications by which the department head or chief executive in a city can prepare periodic or annual reports.

National Paint, Oil, and Varnish Association (Inc.), G. V. Horgan, general manager, 2201 New York Avenue NW., Washington, D. C. A joint committee, known as the committee on simplification and composed of representatives of the American Paint and Varnish Manufacturers Association and of this association, conducts all work in standardization for the industry. This committee has been instrumental in eliminating superfluous sizes of containers and color varieties in paints, varnishes, etc. The association is officially represented on the A. S. A. sectional committee on scheme for identification of piping systems.

National Paper Box Manufacturers Association, Howard P. Beckett, commissioner, Liberty Trust Building, Philadelphia, Pa. A standard terminology has been adopted by this association, including terminology of box construction, materials, machines, terminology of processes, methods of expressing measurements, and standard names for various types of boxes. This association cooperated with other units of industry in the establishment of a limited number of standard box board thicknesses which have been accepted by industry and promulgated as a simplified practice recommendation.

National Paper Trade Association of the United States, A. H. Chamberlain, executive secretary, 420 Lexington Avenue, New York, N. Y. This association cooperated with the National Association of Purchasing Agents in the development of standard sizes for catalogues and paper in sheets. It also cooperated with the Bureau of Standards in the establishment of simplified practice recommendations relating to hard fiber twines, tissue paper, and

No. 1 kraft sealing tape, and is now cooperating in formulating recommendations in connection with standard sizes and dimensions of glassine bags and polished cotton twine. At one of its recent conventions this association adopted resolutions recommending to its membership that it request their manufacturers that they identify by numbers, designs, and wording all paper bags, tissue paper, toilet paper and towels, gummed kraft paper, binder's board, and hard and soft fiber twine as conforming to the requirements set forth in the simplified practice recommendations relating to these commodities. In accordance with these resolutions the association's secretary is instructed to furnish members with suitable stickers to be affixed to their orders when purchasing any of the above merchandise, thereby calling the resolutions to the attention of the manufacturers.

National Paving Brick Manufacturers Association, G. F. Schlesinger, chief engineer and managing director, National Press Building, Washington, D. C. The specifications for bituminous filled brick pavements adopted by the American Association of State Highway Officials and the standard specifications for vitrified brick pavement adopted by the American Society of Municipal Engineers have been approved and published by this association. The association makes an annual survey of the sizes and varieties of paving brick shipped and the results were embodied in a report to the permanent committee on simplification of variety and standards for vitrified paving brick in connection with the annual review of the simplified practice recommendation on paving brick promulgated by the U. S. Department of Commerce.

National Petroleum Association, Fayette B. Dow, general counsel, Munsey Building, Washington, D. C. Standards of this association are listed in its publication Summary of Testing Methods and Standards, 1924. In it are listed the various A. S. T. M. and U. S. Bureau of Mines standard methods of test and analysis for gasolines, oils, greases, and other petroleum products, which have been approved as the standards of this association. A department of standards and tests organized by this association is attempting to secure more uniform testing methods and results among the member companies. It follows the practice of sending out samples of the same oil to the various refineries and to the Bureau of Standards and of comparing the test results obtained by the refineries with each other and with the results obtained by the Bureau of Standards. This association cooperates in the preparation of standard methods of test, and specifications for petroleum products by the American Society for Testing Materials, the Society of Automotive Engineers, the American Petroleum Institute, and the Federal Specifications Board. It is officially represented on the board serving in an advisory capacity to the technical committee on lubricants and liquid fuels of the Federal Specifications Board. It cooperated with other organizations, under the American Standards Association procedure, in work resulting in the American standard and tentative standard methods of testing petroleum products and lubricants.

National Preservers Association (Inc.), Daniel R. Forbes, executive secretary, 839 Seventeenth Street NW., Washington, D. C. Definitions and standards for fruit jams, jellies, preserves, apple butter, and other fruit products have been adopted by this association and have been incorporated in bills presented in Congress. These bills also contained provisions for the labeling of fruit products which do not meet the standards so that the actual composition is indicated and adulteration and misbranding prevented. This association cooperated with other units of industry in the establishment of a simplified practice recommendation for sizes and varieties of glass containers for preserves, jellies, and apple butter.

National Ready Mixed Concrete Association, V. P. Ahearn, executive secretary, Stanton Walker, director of engineering, Munsey Building, Washington, D. C. This is a comparatively new organization and it has organized no standardizing committee as yet. However, it is collecting data relating to the factors affecting the production, use, and quality of ready-mixed concrete, and is cooperating with national standardizing organizations in the preparation and promotion of specifications for ready-mixed concrete. It is represented on committees of the American Concrete Institute, the American Road Builders' Association, and the American Society for Testing Materials which deal with subjects pertaining to ready-mixed concrete.

National Recreation Association, Howard S. Braucher, secretary, 315 Fourth Avenue, New York, N. Y. Interested primarily in community recreation, this association has conducted

a number of studies in the recreation field, some of which were for the specific purpose of developing standards. Committee reports cover such fields as training and experience in community recreation work, standards in playground apparatus, recreation standards in city planning, swimming-badge test standards, athletic badge tests, official playground baseball rules, standard rules for playground games, and others. Local recreation authorities are encouraged to adopt the standards recommended by the various committees whose reports are widely circulated. Recommendations made as a result of a nation-wide study of municipal and county parks are being recognized as standards. At the present time committees are working on standards in the construction of playground apparatus, on standards in methods of attendance recording, and playground surfacing. Endeavor is being made to work out with local recreation executives a practical set of standards by which cities might measure their own community recreation service.

National Refrigerator Manufacturers Association, M. C. McLaren, secretary, 140 South Dearborn Street, Chicago, Ill. Through the initiative of this association the standardization of refrigerator ice compartment sizes was undertaken. This resulted in the formulation and acceptance by industry of the simplified practice recommendation on this subject. The association is represented on the A. S. A. sectional committee engaged in the preparation of standards and specifications for refrigerators.

National Research Council, Vernon Kellogg, permanent secretary, 2101 Constitution Avenue NW., Washington, D. C. The council is composed of 11 divisions, each engaged in standardization in some particular field. At the request of the International Research Council and under the auspices of the National Academy of Sciences, the National Research Council has prepared the International Critical Tables of Numerical data, physics, chemistry, and technology, in seven volumes. The council has also published a list of industrial research laboratories, about 1,600 of which have been reported, in which much developmental work leading toward the standardization of industrial processes is being carried on. Through the laboratory for special radio transmission research conducted at the bureau jointly by the Bureau of Standards and the American section of the International Scientific Radio Union, basic work is being done on radio communication. The National Research Council also cooperates with the Bureau of Standards by administering the funds contributed by certain industries to the bureau for special investigations, including investigations of insulating materials, deterioration of paper, gumming of petroleum, acoustics, etc. Cooperating with the division of engineering and industrial research of the council are 12 national engineering organizations which are vitally interested in standardization. Among direct agencies of this division the American Bureau of Welding is conducting investigations of welding problems. The Highway Research Board is concerned with standards for road materials and construction, and with the compilation of a safety code for automobile brakes and brake testing. Other committees of this division have contributed to the standardization of processes and specifications in electrical insulation, industrial, lighting, and heat transmission. The Division of Chemistry and Chemical Technology acts as the American section of the International Union of Chemistry. This division, in cooperation with the American Chemical Society, has published a list of ring systems used in organic chemistry. Committees of the Division of Geology and Geography have encouraged the systematic keeping of drilling records and core materials. This division is represented in the Advisory Committee of the Board of Surveys and Maps of the Federal Government. Committees of the Division of Medical Sciences have developed methods of classifying blood for purposes of transfusion, formulated standard methods for the agglutination test in the diagnosis of infectious abortion. Committees of the Division of Biology and Agriculture are engaged in the development of standard breeding records for farm animals, and in the standardization of the nomenclature of unicellular organisms and of names and species definitions of medicinal plants. The division also supports the work of the committee on nomenclature of the Fifth International Botanical Congress. In the Division of Anthropology and Psychology a committee on the psychology of the highway has studied the design of highway signs and signals which will be in accordance with the correct principles of vision and mental reaction. It is attempting to set safe limits of defective vision for drivers, and is considering the possible adoption of sys-

tems of mental and psychological tests to the examination of drivers of automobiles.

National Restaurant Association, F. J. Wiffler, secretary, 6 North Michigan Avenue, Chicago, Ill. A standard system for record keeping for restaurants has been approved by this association, including standard bookkeeping forms and a uniform classification of restaurant accounts. It has also formulated a model law, and is sponsoring its adoption by States and cities, covering the regulation of sanitary conditions in restaurants and other public eating places. The movement for limiting the number of standard sizes and varieties of cafeteria and restaurant chinaware, initiated by this association, resulted in the adoption by the industry of a simplified practice recommendation covering these items. Efforts are being made to promote the sale of vegetables, fruits, and other forms of produce by weight. The organization contemplates sponsoring a cooperative advertising which should gain greater publicity for these projects and should make them more universal through a strengthened organization.

National Retail Dry Goods Association, Channing E. Sweitzer, managing director, 225 West Thirty-fourth Street, New York, N. Y. Among its other duties, this association takes an active part in the formulation of standards concerning retail store organization, retail systems, retail trade terminology, business practices, and specifications for commodities used in the trade. As a result of a survey made in cooperation with the division of simplified practice of the Bureau of Standards, this association has adopted standard size specifications for paper bags and boxes which are used as packing and wrapping supplies in retail stores. At the present time, special committees are being appointed to develop standard performance specifications for these and other wrapping supplies, such as wrapping paper, tissue, and gum paper, and twine. During the past year, the association adopted a standard terminology for ready-to-wear sizes which has been generally accepted by manufacturers in the trade. The association also cooperated in the establishment of commercial size standards relating to knit underwear, men's pajamas, boys' blouses and shirts, dress patterns, and women's circular flat knit rayon underwear. The association maintains and operates the Better Fabrics Testing Bureau as a service laboratory for its member stores in making tests of purchases, in developing buyers' specifications for member stores and also consumer standards, and in establishing standards of quality for specific price range merchandise. It carried forward work which resulted in the standardization of sizes for men's, women's, and children's underwear and in the development of specifications for the rayon industry. In connection with codes of business ethics, this association has adopted standards of practice for retail advertising, and in cooperation with the millinery and furniture industries, it has agreed upon standards of business practice as regards relations between buyers and sellers. It also cooperated with the Textile Color Card Association of the United States and with associations of manufacturers of piece goods, apparel, and accessories in the development of color coordination of basic and accent colors to be featured each season.

National Retail Hardware Association, H. P. Sheets, managing director, Meyer-Kiser Bank Building, Indianapolis, Ind. For a number of years this association has cooperated with other units of industry in establishing limiting lists of standard stock sizes and varieties of hardware items. These activities have resulted in the adoption by industry of the simplified practice recommendations covering files, rasps, paint and varnish brushes, cut tacks and small cut nails, loaded paper shot shells, builders' hardware, woven-wire fence, shovels, garden hose, forged tools, and other lines. Within its own particular field it has done much in the simplifying of retail hardware accounting practices, budget operation, control of stocks, improvement of store equipment, and the reduction of duplications and other forms of waste elimination.

National Retail Lumber Dealers Association, Adolph Pfund, secretary-manager, 326 West Madison Street, Chicago, Ill. This association took an active part in the lumber standardization program which resulted in the American lumber standards for softwoods as promulgated in Simplified Practice Recommendation R16. It encourages its member companies to adhere to these standards and to use tally car cards by which car contents are described in terms of American lumber standards. The inclusion of a moisture content requirement in lumber grading rules is being recommended to all lumber manufacturing associations by this organization. Such a require-

ment has already been adopted by the Southern Pine Association.

National Safety Council, W. H. Cameron, managing director, 20 North Wacker Drive, Chicago, Ill. The purpose of this organization is the conservation of human life through a continuous campaign of accident prevention that is nation-wide in scope and includes the improvement of health conditions and prevention of vocational diseases in American industry. In cooperation with other organizations the National Safety Council has taken an active part in the standardization work of the American Standards Association and is sole or joint sponsor for 16 safety codes. Nine of these codes have been completed, as follows: Colors for gas-mask canisters; colors for traffic signals; forging and hot-metal stamping; ladders; paper and pulp mills; identification of piping systems; power presses and foot and hand presses; rubber mills and calenders; and textiles. The seven codes which are still in process of preparation include compressed air machinery; construction work; floor and wall openings; rubber machinery; method of recording and compiling industrial accident statistics; walkway surfaces; and window washing. The National Safety Council actively promotes the use and adoption of all safety codes among its industrial members, which comprise about 70 per cent of the membership. It is formulating and publishing a series of engineering pamphlets discussing ways and means to eliminate accident and health hazards encountered in various industries. To date, 154 of these pamphlets have been published, those issued during the past year being: Safe practices in handling compressed gases; accident prevention in industrial power departments; safety in hotels; cement rock quarrying and crushing; safety and health in tunnel and caisson work; testing, care, and use of linemen's rubber protective equipment; benzol; and spray coating. Committee reports have been presented on research on low-voltage electrical hazards and on the effects of annealing on chains.

National Sand and Gravel Association, V. P. Ahearn, executive secretary, Stanton Walker, director of engineering and research division, Munsey Building, Washington, D. C. Major activities of the engineering and research division relate to the standardization of requirements for materials. A committee on standard specifications of this association is working on a program of simplification of aggregate sizes in cooperation with the division of simplified practice of the Bureau of Standards, the National Crushed Stone Association, and the National Slag Association. Standard commercial sizes for gravel have been approved by the membership of the association. The association is represented on, and is active in the work of major committees dealing with aggregates and products utilizing aggregates in the following technical societies: American Concrete Institute, American Railway Engineering Association, American Society for Testing Materials, American Road Builders Association, Highway Research Board, and American Standards Association. Supplementing its activities in cooperation with standardizing bodies this association is engaged in field and laboratory research work for the purpose of developing information on the best practices for using aggregates for a wide variety of purposes. The association now is engaged in the development of uniform cost-accounting practices, safety standards for sand and gravel plants, and standards for condition of railroad cars for transportation of sand and gravel.

National Scale Men's Association, C. L. Richards, secretary, Bureau of Standards, Clearing Station, Chicago, Ill. This association has contacts with working committees of individuals representing the interests of the American Railway Engineering Association, the Scale and Balance Manufacturers Association, and the weights and measures division of the Bureau of Standards. It has adopted the following specifications: Overhauling and repair of heavy capacity scales, 1929; light industrial service track scales, 1930; railway track-scale test weight cars, 1931. Current and incomplete specifications or standardizing projects which will be completed within the next year are: Preparation of a code of rules for maintenance and operation of track-scale test weight cars; preparation of a definition of what constitutes proper and adequate test of a railroad track scale. The standards and codes which this association has already published and adopted have received the indorsement of the National Conference on Weights and Measures and the American Railway Engineering Association.

National School Supply Association, J. W. McClinton, executive secretary, 176 West Adams Street, Chicago, Ill. The movement which resulted in the adoption by industry of the simplified

list of standard colors for school furniture was initiated by this association. It more recently began a certification service for janitor supply products, in accordance with which the association issues labels to manufacturers who have supplied samples which conform with standards of the association. Manufacturers may attach these labels to their products, and school buyers are encouraged by the association to specify the certified and labeled products in their purchase orders. Standard specifications to which the certification service applies are published in a pamphlet, "Certified Janitor Supply Products." They include liquid soap, scrubbing soap, disinfectants, and deodorants. It is expected that floor brushes and standard containers will later be added to the list.

National Slag Association, H. J. Love, manager, 937 Leader Building, Cleveland, Ohio. Standard specifications for slag to be used in highways and highway structures are published and recommended by this association. These specifications include standard definition of slag, classification, commercial names, requirements on unit weight of slag for various types of highway construction, and requirements on screen grading of granulated slag for brick cushion and for granulated slag base. This association cooperates in the standardization activities of other organizations, such as the Federal Specifications Board, the American Concrete Institute, and the American Society for Testing Materials. It maintains a research laboratory which is now working on a 10-year test program for the determination of the properties of concretes made with 32 different aggregates including traprock, granite, limestones, dolomite, gravels, and slags.

National Slate Association, W. S. Hays, secretary, Drexel Building, Philadelphia, Pa. Standard specifications have been formulated and recommended by this association covering the use of slate for floors, terraces, walks, and roofs. These specifications are in the form in which they may be incorporated into architects specifications or made the subject of construction contracts, and for slate roofs include requirements on metal work, weight, and laying of felt, laying of slate, etc. This association actively sponsored standardization activities which resulted in the acceptance by industry of a limited number of standard sizes and varieties of structural slate for plumbing and sanitary purposes, roofing slate, and blackboard slate, as promulgated in simplified practice recommendations. It is represented on three A. S. A. sectional committees.

National Soybean Oil Manufacturers Association, W. H. Eastman, president, box 603, Milwaukee, Wis. Standardization of its product is one of the activities of this association which was organized in 1930. Its finished-material standards committee was formed to cooperate with the American Society for Testing Materials, the Bureau of Standards, the Federal Specifications Board, and other agencies in maintaining standards for the association's products which will afford commercial protection to both buyer and seller. The duties of other of its soybean grades and contract committees, are to see that fair and just grades for soybeans are established by the U. S. Department of Agriculture or other agency so that equal protection is afforded to buyer and seller. The activities of this association resulted in the adoption in May, 1930, of specifications for purity and quality of crude domestic raw soybean oil. Standard trading rules and a code of ethics have been established and adopted by the association.

National Supply and Machinery Distributors Association, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. Cooperation with other associations and members of industry in the establishment of limited lists of standard sizes and varieties of hardware items and machinery supplies as embodied in simplified practice recommendations promulgated by the Bureau of Standards, is an important function of this association.

National Tent and Awning Manufacturers Association, J. E. Dilg, president, 116 South Fourth Street, St. Louis, Mo. Standard definitions of terms relating to cotton fabrics in the awning, tent, and tarpaulin trade have been prepared and adopted by this association in cooperation with the Cotton Textile Institute. This association has adopted the recommended practice of marking cotton tents and tarpaulins with the actual weight of the untreated gray goods and the type of fabric, and is sponsoring the adoption of this practice by industry in general.

National Terra Cotta Society, W. F. Lockhardt, secretary-director, 230 Park Avenue, New York, N. Y. This organization cooperated with the

American Institute of Architects in formulating standard specifications for the manufacture, furnishing, and setting of terra cotta. In its volume entitled "Terra Cotta—Standard Construction" the society has included among other things 67 large-scale plates relating to typical architectural details for the purpose of assisting architects and engineers in drawing up specifications concerning the proper use of terra cotta. The society is now engaged in preparing technical standards relating to strength and absorption of architectural terra cotta which it is expected will be officially adopted by the industry.

National Tuberculosis Association, Kendall Emerson, M. D., managing director, 450 Seventh Avenue, New York, N. Y. The diagnostic standards committee, appointed by the president of this association, has compiled the ninth edition of the publication relating to standards for the diagnosis and classification of tuberculosis of the lungs and tracheo-bronchial lymph nodes. Another committee of this association, in cooperation with a similar committee of the American Sanatorium Association, has adopted minimum standards in connection with location, construction of buildings, and administration of the tuberculosis sanatoriums and hospitals in the United States, which have been adopted and reaffirmed, during the past year, by both organizations.

National Wall Paper Wholesalers' Association, Justin P. Allman, president, 1522 Chestnut Street, Philadelphia, Pa. Standardization activities initiated by this association, and cooperated in by the Wall Paper Association of the United States, resulted in the adoption by industry of the commercial standard for wall paper covering quality requirements, fade-proof characteristics, etc.

National Warm Air Heating Association, Allen W. Williams, managing director and treasurer, 3440 A. I. U. Building, Columbus, Ohio. The eighth edition of this association's standard code regulating the installation of gravity warm-air heating systems in residences, was approved in August, 1931. This code covers methods for determining the sizes of warm-air pipes, wall stacks, and furnaces, and rules for the installation of furnaces, pipes, wall stacks, and for the construction of chimneys. The association has a symbol which may be attached to an installation by a dealer who has pledged himself to install warm-air heating systems in accordance with the specifications in the above code, which has been approved by the American Society of Heating and Ventilating Engineers and the National Association of Sheet Metal Contractors.

National Watch Case Manufacturers Association, Alexander Vincent, secretary, 20 West Forty-seventh Street, New York, N. Y. A series of standard markings for watch cases, developed by this association, formed the basis of a trade-practice conference of the watch-case industry under the auspices of the Federal Trade Commission. The standard practice adopted by industry as a result of this conference covered three classes of time guarantees for watch cases with requirements on thickness of gold or gold alloy sheet for various parts of case and for each class of time guarantee. All nickel or base metal cases are to be stamped "nickel" or "base metal."

National Wholesale Druggists' Association (Inc.), E. L. Newcomb, secretary, 51 Maiden Lane, New York, N. Y. The statistical division of this association has prepared and issued bulletins relating to standard methods in connection with the purchasing of standard proprietaries by wholesale druggists, standard method of cost analysis, and standard balance-sheet account classification. In addition to the development of the simplified-invoice form and the standard price card, this association cooperated with the Wholesale Stationers' Association of the United States of America in the adoption of a standard size catalogue page with recommendations as to the style of printing and size of type to be used. It sponsored the movement for the packaging of razor blades and flashlight batteries which resulted in the establishment of simplified practice recommendations covering these projects. The association also cooperated with the division of trade standards of the Bureau of Standards in the establishment of the commercial standard for clinical thermometers.

National Wholesale Grocers' Association of the United States, M. L. Toulme, secretary, 99 Hudson Street, New York, N. Y. This organization takes an active part in the establishment of simplified practice recommendations promulgated by the Bureau of Standards in connection with sizes of containers for canned foods, and cooperates with the Food and Drug Administration of the U. S. Department of Agriculture in the enforcement of the several Federal laws enacted by

Congress relating to standards for canned foods.

National Wiping Cloth Standardization Association, Charles M. Haskins, secretary, Times Building, New York, N. Y. This association functions as a division of the National Association of Waste Material Dealers. It cooperates with various elements in industry for the purpose of making available to consumers wiping cloths which are guaranteed to comply in quality with certain standards specifications. In order to bring this about the association has inaugurated a guarantee plan which provides that every member of the association may continue to sell his wiping cloths under any classification or designation that he may see fit to use. At the same time certain standard classifications will be set up under which cloths will be sold with a guarantee to the consumer that they are packed in accordance with the association's standard specifications relating to quality. These cloths will be known as NAWMD Certified Wipers, and each member desiring to handle wiping cloths under the guarantee will be furnished by the association with a certificate, bearing a permit number and a standard tag, which may be placed in or attached to bales or packages shipped. Members taking advantage of this plan sign an agreement to observe certain obligations.

Natural Gasoline Association of America, Ray E. Miller, secretary, 819 Wright Building, Tulsa, Okla. New specifications for gasoline extracted from natural gas, which have been prepared by this association, will become effective for grading of natural gasoline produced by association members after January 1, 1932. This association cooperated with other organizations, under A. S. A. procedure, in the establishment of American standard methods of testing petroleum products and lubricants.

New England Council, Dudley Harmon, executive vice president, Ray M. Hudson, industrial executive; Sidney B. Jewett, agricultural executive; Statler Building, Boston, Mass. The council is composed of 12 men from each State, elected for a 2-year period by representatives of the agricultural, commercial, industrial, and other business organizations of New England, in attendance at the New England Conference held annually in Boston. In the industrial line it has published articles dealing with the use of research in developing old products and introducing new ones, bettering production methods, and stabilizing employment. In the agricultural field it has a farm marketing program by which the State agricultural departments of the six New England States are cooperating with farmers in the grading, labeling, and identification of New England farm products. This program calls for the grading of produce in accordance with official State grades established and promulgated by the commissioner of agriculture of each State. Goods packed in accordance with these grades may be identified by means of the New England quality farm products label, which is identical for the various States with the exception of the State name. The commissioner of agriculture establishes grades at the request of the growers of his State, calling them into meetings to aid him in determining what the requirements of any particular grade should be. To protect the reputation of the label, each State department of agriculture maintains an inspection service with trained field men whose duties are to examine graded and labeled products in the ordinary channels of trade to see that they meet the requirements. The market for graded and labeled goods is promoted by instructing the housewives in the meaning of the label and showing them in what way it is to their advantage to use labeled goods. In this work the New England Council is greatly aided by a cooperating Women's Committee on Agriculture, appointed from the New England Conference of State Federations of Women's Clubs. The use of grades is not compulsory on the producer, but any one desiring to use the New England label must grade his products properly, the right to use this label being taken away if his product falls below the requirements of the grade. The details of the marketing program are in the hands of the directors of the bureaus of markets of the State departments of agriculture which have an organization known as the New England Association of State Marketing Officials. Through frequent meetings of this latter association the efforts of the various States are coordinated, and the grades on the various products are, to all practical purposes, uniform in all the States.

New England Water Works Association, F. J. Gifford, secretary, 715 Tremont Temple, Boston, Mass. Standardization activities of this association are carried on in cooperation with other organizations. It is acting as joint sponsor, under A. S. A. proced-

ure, in the preparation of specifications for cast-iron pipe and special castings. It has also cooperated in four additional A. S. A. projects.

New York Produce Exchange, W. C. Rossman, secretary, 2 Broadway, New York, N. Y. In addition to its other duties the exchange has appointed committees to regulate the inspection, quality, and standards of the various commodities handled by its members, as follows: Provisions, meats, grain, flour, petroleum, vegetable products, and hay and straw. In the case of cottonseed products samples are submitted to the bureau of chemistry of the exchange for analysis, and are tested in accordance with official methods adopted jointly by the National Cottonseed Products Association and the American Oil Chemists' Society, and graded accordingly. In making tests for animal and vegetable oils, waxes, and fats, the exchange employs the methods adopted by the American Oil Chemists' Society, or the Association of Official Agricultural Chemists.

Nonferrous Ingot Metal Institute, R. D. T. Hollowell, secretary-manager, 308 West Washington Street, Chicago, Ill. Representatives of this institute, which is made up of nonferrous smelter owners and operators, cooperated in the preparation and the 1931 revision of the American Society for Testing Materials tentative specifications for copper base alloys in ingot form for sand castings. It maintains a research associate at the Bureau of Standards for carrying through physical tests of nonferrous ingot metals.

Northeastern Retail Lumbermens Association, Paul S. Collier, secretary-manager, Temple Building, Rochester, N. Y. A standardization committee of this association cooperated with the National Lumber Manufacturers Association in the standardization program which resulted in the promulgation of the simplified practice recommendation on softwood lumber. In its 1931 convention it adopted resolutions indorsing and recommending the lumber distribution declaration of the National Retail Lumber Dealers Association. In a further resolution, this association indorsed the efforts of the organized manufacturers to assist the retailer by grade marking, car certificates, and local inspection service, and urged the manufacturers' associations to assist in this movement by an intensive publicity campaign with the architects, loaning institutions, and contractors, and to acquaint the latter with the advantages of these facilities as guarantees of honest grade and tally.

Northern Hemlock and Hardwood Manufacturers Association, O. T. Swan, secretary-manager, Oshkosh, Wis. Standard grading rules for hemlock and tamarack lumber have been formulated and adopted by this association, these rules conforming to the American lumber standards for yard lumber. The organization also formulates and issues rules governing the grading and inspection of white cedar shingles. For hardwood lumber the association has adopted the grading rules of the National Hardwood Lumber Association. It maintains a system of branding and grade marking by which the licensed member firms may use the association's brand in addition to the indication of grade on hemlock lumber shipped in accordance with the association grades. In addition the licensed member firms are permitted to use association car certificates by which the manufacturer certifies the original tally and inspection of a particular car of hardwood or softwood lumber and an attached coupon guarantees an impartial association inspection in case of a claim on grade or tally by the consumer.

Northern White Cedar Association, Norman E. Boucher, secretary, 702 Lumber Exchange, Minneapolis, Minn. Specifications governing the manufacture and grading of northern white cedar poles were adopted by this association in 1925, and in 1927 it adopted specifications governing the manufacture and grading of northern white-cedar posts. It is at present attempting to have the various State highway commissions make their specifications for guard-rail posts to conform to the association specifications. The association is represented on two A. S. A. sectional committees.

Oak Flooring Manufacturers' Association of the United States, W. L. Claffey, secretary, 604 Dermon Building, Memphis, Tenn. Standard oak flooring grading rules have been established by this association, the effective date of the latest edition of the rules being January 1, 1931. It also publishes data and recommended practice on the construction of subfloors and the laying and nailing of oak flooring. Through representation on committees working under the auspices of the American Standards Association, this association assisted in the preparation of the American standard safety code for woodworking plants.

Outdoor Advertising Association of America (Inc.), John Paver, plant development division, 165 West Wacker Drive, Chicago, Ill. The standards of this association are published in a manual dated 1926 with a 1931 supplement giving the latest revised standards. A new manual is contemplated for the near future. The supplement gives the association's standard method of determining coverage allotment to give adequate coverage of a city or town and also the standard method of determining the travel habits of the people and the flow of traffic of a city or town. The association has prepared and published a poster advertising a complete survey manual indicating the methods of making traffic flow maps, market analysis maps, etc.

Paperboard Industries Association, G. R. Browder, general manager, 608 South Dearborn Street, Chicago, Ill. In cooperation with other units of the industry this association was effective in the general acceptance of a limited list of standard thicknesses of box board as promulgated in a simplified practice recommendation issued by the Bureau of Standards. Its standards are published in a booklet which contains gage lists for box board in conformity with the simplified practice recommendation, and also requirements on packing, trim of machine, sampling for bursting-strength test and for weight test, moisture content, bend test and waterproofing test, and permissible variations in weight and caliper. The association also publishes a handbook of useful information which contains standard nomenclature methods of construction, and illustrations of corrugated and solid-fiber containers and component parts. During the past year it cooperated actively in the development of standard sizes for canned-food boxes; and in the development of two standard sizes of folding boxes for one pound of coffee. Members of the association are permitted to use its insignia on the certificate placed on boxes built to conform to the Consolidated Freight Classification or Express Classification of the railroads.

Pine Institute of America (Inc.), C. F. Speh, secretary, Barnett National Bank Building, Jacksonville, Fla. Rosin and turpentine are the principal products in which this organization is interested. Standard grades for rosin are provided for in the Federal naval stores act which is administered by the U. S. Department of Agriculture. Standards for grades of turpentine are being developed through the American Society for Testing Materials, with which the pine institute cooperates. The pine institute is continuing its efforts to standardize the rosin barrel by still further tightening the specifications as adopted by the Naval Stores Boards of Trade. It is also continuing its activities in standardizing methods of woods operations, such as the general size of trees to be worked, specifications for the character of the work, depth of chipping, height of chipping, etc.

Plumbago Crucible Association, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. Through the efforts of this association the members of the industry agreed upon a standardization of tilting furnace crucibles by adopting a standard form of spout and agreeing to use standard sizes of brass melting pots in connection with these spouts. This association served as joint sponsor with the American Foundrymen's Association for the A.S.A. sectional committee on outside dimensions of crucibles for melting furnaces in nonferrous foundries.

Plumber's Woodwork Institute, R. Kennedy Hanson, chairman, 916 Clark Building, Pittsburgh, Pa. Eleven manufacturers of plumbers woodwork comprise the membership of this association. Its standardization committee initiated the preparation of the commercial standard for staple seats for water closet bowls.

Plywood Manufacturers Association, Alexander D. King, acting commissioner, 178 West Adams Street, Chicago, Ill. At the request of this association there was called a general conference of manufacturers, distributors, and users of plywood, at which was formulated the commercial standard for plywood, which was recently accepted as the standard of the plywood industry. This standard defines the various quality grades and types of plywood and veneer.

Portland Cement Association, Wm. M. Kinney, vice president and general manager, 33 West Grand Avenue, Chicago, Ill. This organization has cooperated with the following associations and societies in the formulation of specifications for Portland cement, concrete and concrete aggregates, construction of buildings, highways, and other structures: American Society for Testing Materials, American Concrete Institute, American Concrete Pipe Association, American Petroleum Institute, American Society of Municipal Engineers, American Association of State Highway Officials, American

Road Builders Association, Cast Stone Institute and Highway Research Board. The association recently assisted the American Society for Testing Materials in the development of specifications for concrete masonry units, assisted the American Concrete Institute in the preparation of specifications for cast stone and specifications for concrete burial vaults, and assisted the Cast Stone Institute in the preparation of an architect's specification for cast stone. It cooperated with other units of the industry in the establishment of the simplified practice recommendation for concrete building units, and is now cooperating in the development of Federal specifications for cast stone and concrete masonry. The association is represented on six A. S. A. sectional committees, and on the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, where it is affiliated with four other organizations. Among the educational publications of this association are included many specifications from various sources. The most recent of these contain specifications for small store buildings, plain and reinforced concrete using water cement ratio method, and reinforced concrete tennis courts, 1931 summary of concrete road specifications used by State highway departments, and specifications for cast stone. This association conducts a research laboratory engaged in studying concrete and concrete materials and maintains four research associates at the Bureau of Standards investigating the constitution and hardening of Portland cement. Membership in the Portland Cement Association is contingent on the members' product conforming to the specifications of the American Society for Testing Materials.

Power Piping Society, Stuart J. Swensson, secretary, 1714 Clark Building, Pittsburgh, Pa. Standard specifications for power piping recommended as minimum requirements for a safe, economical, commercial installation have been adopted by this association. The specifications have been compiled as a guide for framing actual specifications for an installation job, and cover the conditions ordinarily encountered in power plant piping.

Power Transmission Association, W. S. Hays, executive secretary, Drexel Building, Philadelphia, Pa. Standardization activities of this association are carried on in cooperaton with other organizations under the procedure of the American Standards Association. These activities have resulted in the American standard safety code for mechanical power transmission. Work is still in progress on three other projects.

Pulverized Fuel Equipment Association, F. H. Daniels, president, care of Riley Stoker Corporation, Worcester, Mass.; W. L. Martwick, secretary-treasurer, care of Foster Wheeler Corporation, 165 Broadway, New York, N. Y. The chief activity of this relatively young association has been its cooperation with the National Board of Fire Underwriters in connection with the rules promulgated by that body for the installation of pulverized fuel equipment. The various pulverized fuel equipment manufacturers believed it to be highly important to associate for this purpose, in order that the National Board of Fire Underwriters could have an authoritative body to consult in the formulation of rules and the revision of the present rules. The association is represented on the A. S. A. sectional committee on safety codes for the prevention of dust explosions.

Pyroxylin Plastics Manufacturers Association, John E. Walker, secretary, 1001 Fifteenth Street NW., Washington, D. C. The trade customs committee of this association has authority to consider all matters relating to standardization of products, codes of ethics, and other trade practices. Standards for pyroxylin sheets, rods, and tubes, prepared and recommended by this committee were approved by the association at its June, 1931, meeting. These standards cover standard sizes, dimensions, and tolerances.

Radio Manufacturers Association (Inc.), M. F. Flanagan, executive secretary, 32 West Randolph Street, Chicago, Ill. The activities of this association include the standardization of size and characteristics of radio apparatus to promote interchangeability of parts, and the setting of standard ratings for the properties or performance of material or apparatus, as contrasted to the work of the Institute of Radio Engineers, which includes standardization of terms, definitions, and symbols, and methods of testing materials and apparatus in order to determine their important characteristics. Standards adopted by this association include methods of testing and test requirements for cords, plugs, jacks, audio transformers, capacitors, audio coupling, dry cells, standards relating to equipment supplied with radio receivers, standard dimensions of

terminals, binding posts, screws, plugs, jacks, pilot lamp, vacuum tube sockets, standard ratings of resistors, capacitors, storage A and B batteries, dimensions and terminal markings of dry cell batteries, terminal markings of socket power units and power cables, impedance limits and polarity marking of head sets, standards on direction of television scanning and on television detail and speed. This association has committee representation on work going forward on radio standardization under the auspices of the American Standards Association.

Rag Content Paper Manufacturers, E. H. Naylor, secretary, Box 245, Springfield, Mass. Members of this organization have established the following as a standard: Papers having less than 25 per cent rag content shall not be watermarked, labeled, advertised, or sold as rag content papers.

Rail Steel Bar Association, H. P. Bigler, secretary, 228 North La Salle Street, Chicago, Ill. For approximately two years the member mills of this association have followed a certification plan by which deformed rail steel reinforcing bars are marked with a permanently rolled symbol. This symbol is evidence of manufacture by a member of the association and designates the material as rail steel rolled in accordance with the general standards of the industry and meeting the requirements of the association for quality. The symbol further indicates a willingness to certify to this quality. As now operating, certification is made on a basis of the requirements of any one of the following standards, all of which are in substantial agreement: American Society for Testing Materials specification A16–14 for rail steel concrete reinforcement bars; No. 350a (QQ–B–71) of the Federal Specifications Board, specifications for rail steel concrete reinforcement bars of the Association of American Steel Manufacturers, and specification G31–1930 of the Canadian Engineering Standards Association on the same subject. Policing of quality is performed by general tests by the association's committee on metallurgy and by routine tests by the individual mill's inspection departments, as well as by routine inspection customarily required by the consumer. The committee on metallurgy conducts tests on the product of each member mill to determine the general average of quality for the industry and the variations of each mill from this average. The committee also conducts research into various problems of production and the use of rail steel bars and other rail steel products. By presenting the committee findings to the superintendents division, comprising all works managers of the associated mills, standardization of production methods is effected. There has recently been established a committee on engineering whose duties will be to supplement the work of the committee on metallurgy in establishing certain technical facts concerning the use of rail steel reinforcing bars as concrete reinforcement. The effect of this work will be a standardization of sales engineering data.

Railway Accounting Officers Association, E. R. Woodson, secretary, 1124 Woodward Building, Washington, D. C. Adoption of standard commodity classifications, uniform interline accounting, simplification of accounting procedure, and the adoption of uniform methods are some of the standardization accomplishments of this association. It cooperated with the Interstate Commerce Commission in formulating a standardized system of accounting for the railway carriers and promulgating specifications relating to forms and reports required of the carriers. This association cooperated with several national trade associations and business organizations in evolving the simplified practice recommendation for commercial forms such as invoices, purchase orders, etc., and the simplified practice recommendation relating to bank checks, notes, drafts, and similar instruments. It is represented on the standing committees for both of these recommendations. The recommended standard practices adopted by this association are included in its book, Railway Accounting Procedure, which is used not only as a reference book on railway accounting but also as a textbook. This book contains all of the standard forms approved by the association, a number of which are mandatory, while others are recommendatory, and some informative.

Railway Fire Protection Association, R. R. Hackett, secretary, care of Baltimore & Ohio Railroad, Baltimore, Md. A handbook of recommended standards and suggestions for the protection of railroad property and the prevention of fire losses has been issued by this association. In the revised edition of the handbook, which is now in preparation, will be included recommendations regarding the construction and fire-hazard prevention of grain elevators and storehouses, and

the safe storage of records. New standards and recommendations are in the process of preparation for natural gas and gasoline pipe lines on railroads, snow-melting oil, handling of gasoline, gas systems for welding and cutting, freight-car heaters and refrigerator cars, housing of employees, bridges and trestles, timber-treating plants, fire-alarm signaling systems, air compressors, fuel oil, fire losses in rolling stock, and incinerators. The standardization projects carried out by other organizations with which this association cooperated in the production of the standard include those of the American Railway Association on lacquers and finishes and on highway coaches and trucks; specifications for fire hose of the American Standards Association: general fire protection under the National Fire Waste Council; fire-fighting equipment in metal mines of the American Mining Congress; rules for fire prevention in maintenance of way department of American Railway Engineering Association; and those of the National Fire Protection Association dealing with dust explosions in grain elevators, private fire supplies from public mains, automatic sprinklers, field practice, gases, protection of openings in walls and partitions, storage of combustible fibers, tanks, garages, spontaneous heating and ignition, and arson law campaign.

Red Cedar Shingle Bureau, Arthur Bevan, secretary-manager, Stuart Building, Seattle, Wash. The standardization committee of this organization, known as the grading and packing rules committee, is appointed by the president and contains representatives from each district. It was authorized by the last annual meeting to draw up simplified grading and packing rules based on one uniform method of packing, the rules to conform to the commercial standard for red-cedar shingles resulting from the conference held under the auspices of the division of trade standards of the Bureau of Standards. Under the procedure followed, each district committeeman called a meeting of the manufacturers in his district for the indorsement of the rules prepared by the committee or the discussion of recommended changes. The committee then met to consider recommendations from the various districts, and prepared a set of rules which were eventually almost unanimously agreed to. The commercial standard for red-cedar shingles was adopted by the industry during the current year, and manufacturers representing 95 per cent of the machine capacity of Washington, Oregon, and British Columbia signed acceptances of the standard and expressed their willingness, if requested to do so, to certify that their product was in accordance with the standard. On the basis of the commercial standard, the Red Cedar Shingle Bureau adopted new grading and packing rules which reduce the number of grades from 42 to 14, with three specialty grades in fairly common demand. The new rules also eliminate duplication of pack, all shingles being packed by the square, that is, in accordance with the area covered. The bureau issues a label for the use of mills licensed by it, which certifies that the shingles to which the label is attached are in accordance with the commercial standard. Only those mills which sign contracts to restrict their output to products which meet the new standards and which agree to have their product inspected are allowed to use the label.

Refrigerating Machinery Association, Fred Nolde, secretary, 23 South Fifty-second Street, Philadelphia, Pa. During the past year this association has formulated and adopted as recommended practice, standard specifications for ammonia valves, flanges, and fittings, which have been submitted to the A. S. A. sectional committee on which this association is represented, for such action as the latter may desire to take as regards making them American standards. Representation is maintained on six other A. S. A. sectional committees. The association is also cooperating with the Joint Research Committee on Welded Pressure Vessels with the object of obtaining a revision of the code for unfired pressure vessels of the American Society of Mechanical Engineers; with the Joint Commercial Refrigeration Committee and commercial refrigerator manufacturers for the standardization of construction details for commercial refrigeration installations; and with the Committee on Heat Transmission for the development of an insulation test code.

Rice Millers' Association, R. L. Weber, secretary, Box 1289, New Orleans, La. The standards for milled rice used and adopted by this association are the standard grades promulgated by the U. S. Department of Agriculture and published in the department's Handbook of United States Grades for Milled Rice. These standards are the basis for the inspection service and issuance of certificates as

to grade which are carried on by this association. The association has also adopted standard selling terms which are used by practically all mills in the industry which sell clean rice.

Rubber Manufacturers Association, A. L. Viles, general manager, 250 West Fifty-seventh Street, New York, N. Y. Standards and specifications for the following items have already been adopted by this association: Conveyor and elevator belting, sizes and thickness of rubber floor tile, sizes of rubber soling strips, packing of corrugated matting and running-board material, transmission belting, dimensions of push-type battery covers with bushings, druggists sundries, and mechanical rubber goods. Several technical groups of this organization are now engaged in various projects dealing with the formulation and adoption of standards, several of which have already been completed. The tire manufacturers division is cooperating with the Tire and Rim Association in the development of recommended combination tube sizes. The standards committee of the proofers division cooperated with the Federal Specifications Board in the formulation of the Federal specification for hospital sheeting and with the Association of Pyroxylin Coated Fabric Manufacturers and the Bureau of Standards in the establishment of the commercial standard relating to grades and quality of cotton goods for rubber and pyroxylin coated automotive fabrics. The rubber sundries division of this association, at the request of the American Hospital Association, is now engaged in the formulation of a specification for surgeon's rubber gloves which is expected to be adopted in the form of a commercial standard. The specification committee of the mechanical rubber goods division has prepared standard specifications for wrapped and braided water hose for adoption by the division and for inclusion in the specification data book, the compilation of which is one of a continuing nature. The work relative to the development of model specifications for various types of conveyors and elevator belting for the purpose of eliminating the existing diversity in customers' specifications is being continued by this association. The association cooperates with other national organizations, such as the American Marine Standards Committee and the American Mining Congress, on matters of mutual interest. It is officially represented on five A. S. A. sectional committees.

Sand-Lime Brick Association, John L. Jackson, president, Saginaw, Mich. This association took an active part in the work which led to the adoption by industry of one standard size of sand-lime brick as given in a simplified practice recommendation promulgated by the Bureau of Standards. It is at present represented on the simplified practice committee on masonry opening sizes now working on the standardization of masonry openings. Through its representation on committee C–3 of the American Society for Testing Materials, this association was largely instrumental in obtaining the revision of the A. S. T. M. tentative specification for sand-lime brick so that it was in agreement with the A. S. T. M. specification for clay and shale brick. This specification, as amended, was approved as a standard of the Sand-Lime Brick Association, and in 1930 was adopted as standard by the American Society for Testing Materials. The organization cooperated with the Federal Government in working out Federal specification No. 505, used in the purchase of common sand-lime brick.

Scale and Balance Manufacturers Association, Harry Schroeder, acting secretary, 17 State Street, New York, N. Y. One of the first duties of this association, which was organized during the early part of the World War, was the consideration of standardization and simplification of types and models. During the first year approximately 300 models out of a total of 800 were eliminated, without any practical inconvenience to the general trade and industry. Standardization of railroad track scales, in which this association cooperated, started about 1918 with the work of the so-called Aishton committee and resulted in the publication of a circular of the Bureau of Standards, covering specifications for manufacture and installation of railroad track scales. Since that time the association has cooperated in all of the specification work of the scale committee of the American Railway Engineering Association. This has resulted in the specifications for 2-section railroad track scales, railroad track scales for light industrial service, and grain hopper scales, all published by the Bureau of Standards; and specifications for motor truck scales, built-in scales, and self-contained scales as set forth in A. R. E. A.

Bulletin No. 255. Members of this association's engineering committee are also regular members of the scale committee of the American Railway Engineering Association. The specifications for scales, as promulgated by the Bureau of Standards, have been adopted by this association.

Scientific Apparatus Makers of America, J. M. Roberts, secretary, 100 North LaSalle Street, Chicago, Ill. This organization is at present cooperating with the American Chemical Society, the American Society for Testing Materials, the Surgeon General's Office of the U. S. Army, the American Society of Mechanical Engineers, the Educational Buyers Association, and the Bureau of Standards in the standardizing activities of these bodies as regards laboratory apparatus. It has submitted standard specifications for industrial thermometers to the American Standards Association for approval as American standards.

Shovel and Crane Manufacturers Association, Ferry and Dawson, secretaries, Chandler Building, Washington, D. C. This association has adopted standards of practice applying to the manufacture and sale of full-revolving crawler-mounted types of shovels and dragline excavators up to and including 2-yard capacity and full-revolving crawler-mounted cranes up to and including a designated size of 50 tons. These standards were adopted by this association on March 27, 1931, to become effective on April 1, 1932.

Silk Association of America (Inc.), Ramsay Peugnet, secretary, 468 Fourth Avenue, New York, N. Y. One of the most important developments undertaken by this association during the past year has been the inauguration of a research program embracing all branches of the silk industry for the purpose of compiling for the industry facts which may indicate means for improving trade conditions. Subcommittees comprising members of the industry have been appointed to study such problems as costs, distribution, and budgetary control. The association's raw silk classification committee has issued a progress report on standard methods of testing raw silk. This report eliminates many of the differences between American and Japanese methods, and shows the influence which two international technical conferences have had on the thought of technical men of Japan and the United States. Considerable progress has also been made toward an international raw silk classification. There was also appointed during the past year a joint committee composed of representatives of the National Raw Silk Exchange and this association to recommend modifications in the raw silk classification in use in the market to bring it into harmony with the Japanese raw silk classification. A progress report has been prepared by this committee showing closer agreement between the producing and consuming countries on the subject of raw silk classification. An intercomparison of seriplane readings on China raw silk was conducted between New York importers of China silk and Shanghai inspectors, the purpose of which is to standardize inspection methods of the two markets. The executive committee of the broad-silk division of the association has approved the standards for the examination of finished broad silks. The color coordination committee is continuing its work in cooperation with silk and allied industries looking toward the standardization of seasonal colors. A color survey has been made by the association for the purpose of recommending a limitation in color lines, based on actual needs of the trade. It was suggested that 41 colors be considered the maximum necessary in crêpe de Chine and flat crêpe, 25 in canton crêpe, and 29 in satins. A committee has been appointed to study the standard raw silk rules adopted by the association governing transactions between buyers and sellers of raw silk to determine whether or not revisions are necessary to bring them into line with the most recent market practices. The association is continuing its work in research on weighing and the wearability of weighted fabrics. It is officially represented on the sectional committees on safety code for textiles and standardization of speeds of machinery.

Simplex Concrete Pile Association (Inc.), Archibald L. Jackson, secretary, 149 Broadway, New York, N. Y. Specifications that may be incorporated into a construction contract, covering the driving of the steel form, pouring of concrete, withdrawal of form, depth of driving, and spacing of piles, have been issued by this association.

Society of Automotive Engineers (Inc.), John A. C. Warner, secretary and general manager, 29 West Thirty-ninth Street, New York, N. Y. Approved standards of the society are published in its handbook, which is revised and published in February of each year. Standards adopted semi-annually each year are published in a supplement to the handbook and in-

corporated in the next edition. In the present edition there are more than 600 specifications. During the first half of 1931, which is the period covered by this summary, 27 new and revised specifications were adopted. The new specifications adopted are for airplane landing-wheel low-pressure tires and their rims; aircraft structural tubing; tire valves for low-pressure airplane tires; motor-truck frame lengths (CA dimensions); airplane engine piston and piston-ring oversizes; aluminum alloy brazier-head rivets; and slotted aeronautic shear-nuts and slots for plain nuts. Existing standards and recommended practices that were revised included aircraft instrument cases and mountings; airplane landing-wheel high-pressure tires and rims; airplane high-pressure tire valves; ball-bearing lock nuts and washers; small type aircraft engine-starter mountings; flywheel and clutch housings; airplane fuel-pump mounting; lock washers; metric thrust ball-bearings; motor-truck frame widths; airplane propeller-hubs and shaft-ends, taper and spline types; radiator tie-rod fittings; rod-ends and pins; aeronautic tachometer drive and aeronautic thermometer bulbs. A new standard motor vehicle fleet operation and maintenance cost classification is the first of a number of important specifications in the field of commercial motor-vehicle fleet operation. Progress is being made in formulating other standards including a method of rating motor trucks, toward the promulgation of uniform technical requirements in the regulation of motor vehicles by the States. International agreement has been effected on the standardization of single-row annular ball bearings and progress is being made on other types, notably inch-dimension taper roller bearings. In the electrical field, research is in progress in developing approved specifications for insulated and for high tension ignition cable. New or revised specifications are being developed in practically all automotive fields. These projects include airplane camera mountings; airplane wood propeller mountings; annular and thrust ball bearings; engine valve-seat rings; aircraft steels; carbon and alloy steels and their physical property charts; malleable casting specifications; outboard motor standards; aluminum, brass and copper alloys; spline fittings; automobile body parts; screw threads; and screws, bolts and nuts. For automotive type Diesel engines, standardization of engine nomenclature and parts, such as fuel nozzle connections, connecting rod bolts, and shaft couplings is in progress. A complete set of automotive type Diesel engine testing forms including instruction, specification and test log sheets and a set of curve sheets was completed that are similar to the well-known gasoline engine testing forms that have been widely used for many years. A limited amount of advertising in the society's handbook is restricted to the suppliers of automotive parts or materials conforming to the society's specifications. The 1931 handbook also listed nearly 800 companies that certified that their products conform with S. A. E. specifications. The classification of lubricating oils by S. A. E. viscosity numbers instead of the old systems, such as light, medium and heavy oils, lists nearly 150 oil companies as marketing their products under the S. A. E. numbers. The numbers have also been adopted by many of the automobile vehicle manufacturers in their instructions to vehicle purchasers. Together with the American Petroleum Institute and the National Automobile Chamber of Commerce, the Society maintains research associates at the Bureau of Standards investigating the mutual adaptation of fuels and motor vehicle engines. This research has been in progress for several years and has dealt with many important phases of the fuel problem for motor vehicle and aviation engines, such, for instance, as over-all economy, ease of starting, dilution of crankcase oil, vapor lock in fuel systems and the tendency of fuels to knock. The bureau is cooperating with the department of psychology of George Washington University in a study of fatigue incident to automotive travel, which is being conducted under the auspices of the society with funds provided by representative companies in the industry. The society acts in an advisory capacity on the cooperative committee on motor truck impact tests. Under the auspices of this committee, the U. S. Bureau of Public Roads has been conducting the impact tests. The Bureau of Standards has assisted on instrumentation problems. An investigation of the effect of certain wheel alignment factors on tire wear and steering control has been in progress for some time under the direction of the society. The society is sponsor or joint sponsor for 10 sectional committees working under American Standards Association

procedure, dealing with the following projects, several of which have been completed and published: Aeronautic safety code; antifriction bearings; bolt, nut, and rivet proportions; motor-vehicle lighting specifications; machine pins; plain and lock washers; screw threads; small tools and machine tool elements; transmission chains and sprockets; and wire and sheet-metal gaging systems.

Society for Electrical Development (Inc.), J. Smieton, jr., secretary-treasurer, 420 Lexington Avenue, New York, N. Y. This society comprises in its membership all branches of the electrical industry and is devoted to cooperative educational work. The society has formulated simplified methods of determining outlet spacing, lamp size, and mounting height for general lighting installations in commercial, industrial, and public building interiors—a solution of the essential factors of lighting, including standards of illumination for most industries and classes of business. It has also promulgated a model uniform municipal regulation for installation of electrical wiring equipment. The society has inaugurated a so-called "red-seal plan" for identifying a house that is properly and adequately wired in accordance with approved specifications. The plan involves wiring specifications, an inspection, and an award. Basically, the wiring specifications consist merely of numerical values; that is, the number of circuits, switches, lighting, and convenience outlets, properly located to provide for the convenient use of the various lighting, heating, and power applications in a home. Inspection is provided locally by a representative of a duly authorized operating organization who checks the specifications against the job. If the wiring installation conforms to the specifications, an award is made consisting of a miniature red seal, permanently affixed to some part of the main service panel, and a certificate signed by officers of the operating organization is issued to the house.

Society of Industrial Engineers, George C. Dent, executive secretary, 205 West Wacker Drive, Chicago, Ill. Standardization projects on which this organization are engaged include time-study engineering, production standards, plant maintenance standards, and standardization of management terminology. It is also cooperating with other organizations, under A. S. A. procedure, in the preparation of a safety code for conveyors and conveying machinery and the development of a table of preferred numbers. The latter has been informally approved and recommended to industry for trial.

Society of Motion-Picture Engineers, Arthur C. Hardy, chairman of standards committee, 33 West Forty-second Street, New York, N. Y. Dimensional standards and recommended practice for motion-picture apparatus issued by this society have been approved by the American Standards Association. They include standard dimensions of 35, 28, and 16 mm film, and of motion-picture projector sprockets, apertures, and lenses; taking speed and projection speed of sound pictures; relative location of scanning line; location and width of sound track; definition of safety film; recommended practice on projector speed and camera cranking speed, etc. At the May, 1931, meeting of this society, the standards committee made a report in which was incorporated the recommended layout of a 50 mm film. No action has as yet been taken by the society with respect to adopting this layout as a standard.

Society of Naval Architects and Marine Engineers, H. Gerrish Smith, secretary-treasurer, 29 West Thirty-ninth Street, New York, N. Y. This society has taken part in the standardization movement in cooperation with other interested organizations. It cooperates with the American Marine Standards Committee in its standardization work for the marine industry, and is officially represented on various A. S. A. sectional committees.

Society for the Promotion of Engineering Education, F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa. Standardization activities of this society are carried on in cooperation with other organizations under the procedure of the American Standards Association. Work is under way on the standardization of definitions of electrical terms, standard for graphic presentation, table of preferred numbers, standard scientific and engineering symbols and abbreviations, and standards for drawings and drafting room practice. The society is acting as joint sponsor on the latter two projects.

Society of Terminal Engineers, Charles H. Newman, secretary, 114 Liberty Street, New York, N. Y. This organization serves as a medium for collecting and interchanging information on all phases of terminals, for organizing and carrying on research in the various branches of terminal activities, and for the advancement of ethical and professional standards in

terminal engineering, construction, and operation. In connection with work in standardization, the society is officially represented on three A. S. A. sectional committees. It is cooperating with a committee of the American Society of Mechanical Engineers in research on the properties and life of wire rope.

Southern Cypress Manufacturers Association, T. M. True, secretary, Jacksonville, Fla. Standard grades and classifications of cypress lumber in conformity with American lumber standards have been adopted and published by this association. Members of the association are permitted to stamp their product with the association trade-mark, if the lumber has been inspected by the association and found to conform to the grading rules. The association is a member of the producers council, and also the National Lumber Manufacturers Association, with which it cooperates in standardization work.

Southern Hardware Jobbers Association, S. St. J. Eshleman, secretary, 704 New Orleans Bank Building, New Orleans, La. This association cooperated with the National Hardware Association of the United States and the National Retail Hardware Association in the standardization movement which resulted in the acceptance by industry of the simplified practice recommendation on standard sizes and varieties of loaded paper shot shells.

Southern Pine Association, H. C. Berckes, secretary-manager, New Orleans, La. This association has adopted and publishes grading rules for southern pine lumber under four classifications: The Gulf coast classification of pitch pine resawn lumber and sawn timber; specifications for southern yellow pine car material; specifications for grades of dense longleaf and shortleaf southern yellow pine structural timbers, joists and plank, and utility timbers; and specifications for grades of longleaf and shortleaf southern pine lumber. The last of the above grading rules are in conformity with the American lumber standards for yard lumber. They were revised in August, 1930, as regards dimension and heavy joists and dimension timbers, and were revised in June, 1931, with regard to flooring, common boards and strips, dressed and matched shiplap, barn siding, and grooved roofing. The grading rules of the association are enforced by regular monthly inspections made by inspectors of the association at the mills of the member companies. In addition, a corps of official inspectors is maintained in the consuming territory for investigating complaints of buyers who may believe that they have not received the grades which they purchased. Member firms whose product is inspected may place the association's grade and trade mark on all the lumber they produce. This association was represented on A. S. A. sectional committees on work which resulted in standard specifications for cross ties and switch ties.

Southern Sash, Door and Millwork Manufacturers Association, C. B. Harman, secretary, Forsythe Building, Atlanta, Ga. This association has adopted standard grading rules for doors, windows, and outside blinds.

Southern Supply and Machinery Distributors' Association, Alvin M. Smith, secretary-treasurer, care of Smith-Courtney Co., Richmond, Va. As an organization of distributors this association has participated in standardization projects carried out by industry in general, and it cooperated in the preparation of simplified practice recommendations promulgated by the Bureau of Standards. These projects have included such items as standard sizes of wrought-iron and wrought-steel pipe, valves, and fittings; standard packing of carriage, machine, and lag bolts; and standard sizes of hacksaw blades. This association is at present represented on the A. S. A. sectional committee on standardization of gears, which prepared the tentative American standard for spur-gear tooth form.

Sporting Arms and Ammunition Manufacturers Institute, C. Stewart Comeaux, secretary, 103 Park Avenue, New York, N. Y. Standardization activities of this organization are carried on by a technical committee and a committee on simplified practice. Each company member of the institute appoints a representative to the technical committee. After appropriate study and discussion, using test data supplied by the different companies, the committee makes recommendations to the institute. Its duties include the setting up of industrial standards of dimensions, ballistics, methods of test, forwarding of safety work, and special fact finding of a technical nature. Work on the various subjects is conducted by subcommittees, the entire technical committee passing on their recommendations. The recommendations are approved by the institute as a whole. The names of the subcommittees given below indicate the chief activities of the technical committee:

Proofing methods of small arms to be recommended as standard American practice; standardization of chamber dimensions and of cartridge sizes used therein; methods of determining shotgun shell ballistics; methods of determining rifle-cartridge ballistics; and standard barrels for pressure gauges. All of the above subcommittees have completed their work on certain important calibers. The committee on simplified practice has initiated very important work in simplification of the number of items to be supplied to the trade in the lines of metallic cartridges and of shot shells. During the last seven years the number of shot shell items has been reduced from more than 4,000 to less than 800.

Standard Container Manufacturers, Russell W. Bennett, secretary-manager, Realty Building, Jacksonville, Fla. This association of southern manufacturers of shipping containers for fruits and vegetables has formulated and adopted standard specifications for containers which are embodied in the freight classification and tariffs of the southeastern railroads. These specifications establish standards of dimensions and design which admit a wide interchange of parts between containers for different commodities. The association has worked in close cooperation with the Bureau of Agricultural Economics of the U. S. Department of Agriculture, the Florida State marketing bureau, the Freight Container Bureau of the American Railway Association, the Southern Freight Association, and with representative organizations of growers and shippers.

Steel Barrel Manufacturers Institute, D. S. Hunter, secretary, Keith Building, Cleveland, Ohio. The specifications for steel barrels and drums of the Interstate Commerce Commission for the shipment of inflammable and dangerous liquids and solids, and the specifications for steel barrels and drums embodied in rule 40 of the Consolidated Freight Classification have been adopted as standards by this organization. In addition, it has adopted standard sizes and threading of flanges and plugs for steel barrels and drums, standard plug or bung measurements, and standard spacing of rolling hoops. The institute initiated the movement which resulted in the adoption by industry of a simplified practice recommendation for standard capacities for steel barrels and drums.

Steel Founders Society of America, Granville P. Rogers, managing director, 420 Lexington Avenue, New York, N. Y. Through representation on committees of other organizations, this society cooperates in developing specifications and standards for materials used in and products of the steel-foundry industry. The society cooperated with the Bureau of Standards in the establishment of the commercial standard dealing with foundry patterns of wood. It prepared and issued a booklet in which are set forth standard trade customs to govern transactions between buyers and sellers of steel castings. The society has also adopted for use in the trade standard sales contract, order acceptance, and quotation sheet forms for the purpose of simplifying transactions between steel foundries and their customers.

Steel Joist Institute, Frank Burton, consulting engineer, 1732 Dime Bank Building, Detroit, Mich. When organized in 1928, this association had for one of its objects the standardization of design methods. After some preliminary work it proceeded to consider the standardization of sizes of steel joists. No committee was formed, but the entire membership of the institute, consisting of executives from each member company, discussed the matter at length at its monthly meetings. The consulting engineer of the institute proposed the standards and circulated copies thereof with the revisions made from time to time. Each proposed standard was studied independently by the engineers of the member companies and discussed at the monthly meetings. A standard table containing 14 sizes of joists was adopted on August 20, 1929. Prior to the adoption of this standard each company manufactured from 2 to 20 different joists for each depth, with various safe carrying capacities and methods of design. As a result of a request from the institute, a conference was called by the U. S. Department of Commerce, at which a simplified practice recommendation embodying the standard table of joist sizes adopted by the institute was recommended and accepted by industry.

Structural Clay Tile Association, Edward C. Kerth, secretary, 205 West Wacker Drive, Chicago, Ill. A publication entitled, "Specifications for Structural Clay Building Tile," recommended for standard approved building code and engineering practice has been issued by this association. It has cooperated with the Bureau of Standards in experimental work on the uses, characteristics, and

methods of manufacture of structural tile and took part in the establishment of a simplified practice recommendation relating to standard sizes of tile. A survey is now in progress in connection with a proposed revision of the recommendation. The association has recently set up a quality label service by which the manufacturer certifies that the material to which the label is attached is in conformity with the specifications of the American Society for Testing Materials and the standards of the Structural Clay Tile Association.

Tanners' Council of America, J. L. Nelson, secretary, 41 Park Row, New York, N. Y. In order that a better understanding may be reached between tanners and their customers, the upholstery leather group of this organization during the past year prepared and adopted standard grades and specifications for upholstery leather which cover raw material, definitions, selections, and tensile strength of the various grades. It is recommended in the specifications that the name of the manufacturer, date of shipment, and the grade besides the measurement be stamped on all hides. Another group of this council has cooperated with the division of trade standards of the Bureau of Standards in the establishment of a commercial standard for designation of weights of bag, case, and strap leather.

Tap and Die Institute, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. Much of the standardization work of this organization is conducted under the auspices of the American Standards Association. It is officially represented on three A. S. A. sectional committees. The institute's committee on simplification and standardization is engaged in establishing standard basic mechanical sizes and styles of taps and dies to be listed in revised catalogues.

Technical Institute of the Biscuit and Cracker Manufacturers Association, A. A. Schaal, director, 816 Superior Boulevard, Minneapolis, Minn. Tentative specifications have been set up by this organization on many of the raw materials used in biscuit and cracker manufacture and efforts are constantly under way to raise the standard of the finished products.

Technical Association of the Pulp and Paper Industry, R. G. MacDonald, 18 East Forty-first Street, New York, N. Y. In cooperation with the Bureau of Standards, this association has formulated and adopted 28 standard methods for testing paper. Committees of this association are now engaged in developing additional methods. The association is also cooperating with the American Society for Testing Materials in connection with the development of standard tests for paper and roofing felt. Through its committee on heat, light, and power the association is officially represented on two A. S. A. sectional committees.

Telephone Group. This group consists of representatives of the Bell Telephone System and United States Independent Telephone Association. The American Standards Association secretary of the group is H. L. Huber of the American Telephone & Telegraph Co., 195 Broadway, New York, N. Y. Through representatives, the Bell Telephone System and the United States Independent Telephone Association, individually or as a group, are now assisting in the preparation of 16 standards under the procedure of the American Standards Association. Additional standardization work is carried on through representation on committees of various engineering societies and on committees cooperating with regulatory bodies, such as State commissions, national and international bureaus. Cooperative work is handled with numerous committees of the Telegraph and Telephone Section of the American Railway Association, which body is engaged in the formulation of recommendations and specifications dealing with various phases of communication. The telephone group is sponsor or joint sponsor for two sectional committees as follows: Manhole frames and covers (with the American Society of Civil Engineers) and specifications for wood poles.

Textile Color Card Association of the United States (Inc.), Margaret Hayden Rorke, secretary and managing director, 200 Madison Avenue, New York, N. Y. This association, which is international in scope, has over 1,600 members interested in the adoption of standard colors. It cooperates with leading textile, millinery, leather, hosiery, garment, and kindred industrial trade association groups in the selection of basic shades, and is organized for the promotion of color and its correlation in every related branch of industry. This association is the creator of the standard color card of America, showing 192 staple shades, as well as seasonal color cards, widely used in the textile and allied industries here and abroad. Each spring and fall cards are issued for the textile industries, including

silks, woolens, millinery, shoe and leather, hosiery, and related trades. The U. S. Army color card, showing the official colors for arms and services, as approved and accepted by the Quartermaster General of the U. S. Army, is likewise issued by the Textile Color Card Association. The colors on all cards are identified by standard names as well as by cable numbers, thus insuring an exact color interpretation. The association works in close cooperation with the color coordination committee of the National Retail Dry Goods Association in the selection and promotion each season of basic colors for trade-wide coordination. Official committees of leading manufacturing industries cooperate in this movement, thus bringing about a closer relation between producer and distributor, and a greater use of standard color nomenclature.

Textile Converters' Association, Samuel M. Fisher, secretary, 291 Broadway, New York, N. Y. A joint committee composed of members of this association and the Association of Cotton Textile Merchants of New York, has prepared trade standard definitions of fair trade practices in the sale of and purchase of cotton gray goods for the converting trade. The association has adopted a standard method to be employed by the finishers of cotton fabrics for the return by finishers to the converter of all stretched as well as damaged goods and remnants of finished merchandise over one yard in length. This principle, which has also been adopted by the National Association of Finishers of Cotton Fabrics, has been established as a standard of conduct for the trade.

Tire and Rim Association, C. E. Bonnett, general manager, Guarantee Title Building, Cleveland, Ohio. The association's current standards for tire and rim dimensions are published in the 1931 yearbook of the association. In setting up and broadcasting these standards, this association works very closely with the Rubber Manufacturers Association and the Society of Automotive Engineers. This association cooperated in the movement which resulted in the adoption by industry of a simplified practice recommendation relating to standard sizes of industrial truck tires. The products of the rim manufacturer members of the association are inspected by association inspectors and those rims meeting the association standards are branded with the trade-mark of the association.

Tissue Paper Manufacturers Association, Herbert Thwaite, general manager, 280 Madison Avenue, New York, N. Y. Work in the standardization of toilet tissue sizes, initiated by this association, resulted in the adoption by industry of a simplified practice recommendation on this subject. In furtherance of this standard the association members are using the official label of the association on cartons of toilet rolls, the label guaranteeing the package to be in accordance with the simplified practice recommendation. The label is also a guarantee that the paper contained in the carton is made entirely of new pulp.

Underwriters' Laboratories, Dana Pierce, president, 207 East Ohio Street, Chicago, Ill. Established and maintained by the National Board of Fire Underwriters, this organization tests appliances, devices, machines, and materials for their merits respecting life, fire, and collision hazards, and theft and accident prevention. It formulates standards covering the materials, design, strength, and operating features of appliances and devices and uses these standards as bases for the inspection of appliances and the preparation of lists of devices complying with the laboratories' standards. Two methods of supervision are used for listed devices, in one of which examinations and tests of the appliances are made one or more times yearly and features found not complying with the laboratories' requirements are corrected by the manufacturer or the product is removed from the list. In the other method of supervision, devices and materials are inspected by Underwriters' laboratories inspectors at the factory, and goods complying with the laboratories' standards are labeled by stamps, transfers, or labels, so that they may be recognized wherever found. Of the large number of standards prepared by the organization, those issued or revised during the past year include: Flexible nonmetallic tubing, electrically heated appliances, inclosed switches, Christmas tree and decorative lighting outfits, electric motors for use in atmospheres of combustible dust, rigid-steel conduit, panel boards, transformers, industrial-control equipment, and cotton rubber-lined fire hose. This organization is acting as sponsor under American Standards Association procedure for the preparation of specifications and standards for electrical devices and materials with relation to fire and casualty haz-

ards, completed work under this assignment being represented by the American standard for outlet boxes. It is also officially represented on 24 A. S. A. sectional committees.

United Roofing Contractors Association of North America, E. M. Pope, secretary, 58 West Washington Street, Chicago, Ill. The standards of this association include specifications for gravel and slag roofing for application over board sheathing and for application over concrete. The specifications cover the weights of material, construction and installation requirements, using materials that have been manufactured to the inspection requirements of the association and which bear the label of the association. During the past year there was adopted the standard practice of providing in the construction of insulated roofs a mopped felt seal course of tarred or asphalted felt at intervals of not more than 30 feet in each direction, in addition to the previously prescribed seal course underneath the roofing.

United States Golf Association, Herbert Jaques, chairman, implements and ball committee, P. O. Box 1212, Lowell, Mass. The standardization work of this association is limited to the implements and ball used in the game. The specifications are so worded that a manufacturer has a certain latitude necessary for individual craftsmanship, and yet are rigid enough to eliminate freak or unusual construction which would alter the playing of the game. Any new club or device which is put on the market should be submitted to the implements and ball committee. This committee brings in a recommendation, and the subject is finally acted upon by the entire executive committee of the association. In 1931 the new standard weight and size of golf ball was put into effect. The association rule on form and make of golf clubs states that no substantial departure from the traditional and accepted form and make of golf clubs will be accepted, and that the mallet headed type of club or of clubs having the neck so bent as to produce a similar effect should not be used.

United States Inter-Collegiate Lacrosse Association, E. S. Barber, secretary, 101 Park Avenue, New York, N. Y. A committee of this association formulates and amends the rules for playing the game of lacrosse. The 1931 rules, as adopted by this committee, were approved by the executive committee of the association and were adopted by the lacrosse rules committee of the National Collegiate Athletic Association. Besides the regulations for playing the game, the lacrosse rules contain specifications for the crosse, the ball, the field, and the goals. A list of the models of shoes supplied by various manufacturers, who have furnished samples for approval by the committee, is published by the committee. Samples furnished by the manufacturers are kept on hand for comparison with shoes being supplied.

United States Pharmacopœial Convention, Lewis E. Warren, secretary, 2 Raymond Street, Chevy Chase, Md. Committee on Revision of the Pharmacopœia of the United States of America, E. Fullerton Cook, chairman, Forty-third Street and Woodland Avenue, Philadelphia, Pa. This organization prepares and publishes the pharmacopœia of the United States, the object of this publication being to provide standards of purity and strength for the drugs and medicines of therapeutic usefulness or pharmaceutic necessity sufficiently used in medical practice to receive recognition by the medical profession. The pharmacopœia is revised every 10 years, the last revision taking effect on January 1, 1926. In 1930 a new Committee on Revision was appointed and work has been proceeding since then in preparation for the eleventh revision of the Pharmacopœia. This committee consists of 51 members representative of governmental agencies, National and State medical, pharmaceutical, drug, and chemical associations, and medical schools and schools of pharmacy. The standards given in the pharmacopœia are recognized as legal standards in the enforcement of the Federal food and drugs act and the various State drug laws.

United States Shellac Importers Association (Inc.), L. W. Babbage, secretary, 17 State Street, New York, N. Y. This association collaborated with the American Bleached Shellac Manufacturers Association in the establishment of standard rules and regulations for the sampling and analysis of shellac and has adopted official standard methods of analyses for the determination of rosin, wax, moisture, and arsenic in shellac; also for water soluble extract in orange and white shellac, moisture in dry-bleached shellac, and the determination of the body of shellac varnish. This association has also adopted standards for the principal commercial grades and net

weights of packages of shellac. During the past year it inaugurated a plan for the sampling of all shipments of shellac imported into the United States. The plan provides for a standardization bureau which shall examine each importation of shellac. An examination committee, composed of representatives of member firms, is intrusted with the duty of examining samples of the various grades of shellac and passing upon their quality in accordance with the official rules and regulations of the association. The examination committee issues certificates in triplicate on each lot examined, stating grade, mark, lot number, name of vessel, date of examination, and the committee's award. Copies of certificates are furnished to buyer and seller and another copy is filed with the association. Under the plan provision is also made for the settlement of any disputes which may arise in the operation of the plan, through existing arbitration machinery set up by the association. This organization maintains a research bureau at the Polytechnic Institute of Brooklyn to deal with problems arising concerning the uses of shellac.

United Typothetæ of America, John J. Deviny, secretary, Tower Building, Washington, D. C. A standard cost-accounting system, with standard accounting forms, has been adopted by this association. In addition it has adopted standard estimate forms and standard specification forms for printing work. The association publishes a dictionary of graphic art terms applicable to the printing trade. It is giving its active support to the further standardization of stock sizes of paper for the printing and publishing trade. It cooperated in the establishment, in 1924, of the simplified practice recommendation which now forms the standard on this subject.

Wall Paper Association of the United States, E. D. Belknap, executive vice president, 10 East Fortieth Street, New York, N. Y. This association, representing the wall-paper industry, cooperated with the Bureau of Standards in the establishment of the commercial standard relating to grades and quality of wall paper. It has copyrighted a self-identifying trademark guaranteeing wall paper manufactured by its members to be in accordance with the requirements set forth in the commercial standard relating to this commodity.

Webbing Manufacturers Exchange, Wilwyn Herbert, secretary, 74 Trinity Place, New York, N. Y. A standard of minimum sizes of rubber thread for use in the webbing industry has been adopted by the exchange in cooperation with the Corset and Brassiere Association. The exchange also cooperated with the division of simplified practice in the establishment of standard sizes for shoe goring which formed the basis for the simplified practice recommendation relating to this item. Grading rules relating to the number of cuts or pieces permitted in first-quality goods have been adopted by this organization.

West Coast Lumbermen's Association, W. B. Greeley, secretary, Stuart Building, Seattle, Wash. The standard grading and dressing rules for Douglas fir, sitka spruce, west coast hemlock, and western red cedar lumber, were revised by the association in 1930 in conformity with American lumber standards as detailed in simplified practice recommendation R16. In 1930 this association also adopted standard grades for architectural woodwork which define two standard grades for various types of millwork. Monthly inspection by association inspectors keeps the product of the individual mills up to the standards of the association. In addition to inspection, the association is encouraging the marking of lumber and millwork products with the grade of the product and the symbol of the association. This association cooperated in the establishment of four American standards.

Western Pine Association, David T. Mason, manager, S. V. Fullaway, jr., secretary, Yeon Building, Portland, Oreg. This new association has succeeded both the Western Pine Manufacturers Association and the California White and Sugar Pine Manufacturers Association. It has adopted standard grading rules for ponderosa pine, sugar pine, Idaho white pine, larch, Douglas fir, white fir, spruce, and cedar lumber. These grading rules, with the exception of slight variations in dressed and rough sizes, conform with the minimum American lumber standards are given in Simplified Practice Recommendation R16. During the past year this association adopted standard grading rules for larch and Douglas fir railroad-car material and standard specifications and working stresses for structural grades of larch and inland empire Douglas fir structural joists, plank, posts, and timbers. The association has published illustrated booklets on the properties, recommended uses, and grades of ponderosa pine, Idaho white pine,

and larch. Among the activities that the new association expects to encourage are the grade marking and trademarking of lumber in accordance with the association standards and the use of car cards certifying to the grade of the lumber in individual car shipments.

Western Red Cedar Association, W. H. Jones, secretary, Peyton Building, Spokane, Wash. Official specifications for western red-cedar poles, split and round western red-cedar posts, standard cedar piling, and butt treating for cedar poles have been adopted by this association. A committee of this association worked in cooperation with other bodies, under American Standards Association procedure, in the establishment of tentative standard specifications for wood poles. These latter specifications have not as yet been formally adopted by this association.

Wire Cloth Manufacturers Association, A. M. Ferry, secretary, Chandler Building, Washington, D. C. This is an association of manufacturers of Fourdrinier wire cloth used in papermaking machines. Through its request a general conference of makers and users of Fourdrinier wire cloth was called by the Bureau of Standards. The resulting commercial standard was adopted by the conference in June, 1931, and has since been accepted and become the standard of the industry in general. This standard includes the standard meshes adopted, dimensions of wire and details of weave, packing, storage, care of wire cloth, etc.

Wire Screen Cloth Manufacturers Institute, George E. Watson, secretary, 74 Trinity Place, New York, N. Y. One of the first accomplishments of this organization was the formation of a committee for standardization and simplification. This committee, at the time of the organization of the institute, was composed of a chairman and one representative from each member company. It undertook the study of the trend in the industry for the past five years in order to determine what simplification could be properly effected. Standards prepared by this committee have been approved by all members of the institute. At a conference of manufacturers, distributors, and consumers of wire-screen cloth, convened by the division of simplified practice of the Bureau of Standards, standards proposed by the institute were approved and incorporated into a simplified practice recommendation, which received the written acceptance of 90 per cent of the industry and became effective on October 15, 1931.

Wire-bound Box Manufacturers Association, R. M. McClure, secretary, 111 West Washington Street, Chicago, Ill. During the past year this association participated in the standardization activities of the Bureau of Explosives which resulted in the development of new specifications for wire-bound shipping containers for the transportation of explosives and other dangerous articles. It also cooperated with the Federal Specifications Board in the development of revised specifications for wire-bound containers for domestic shipment of Government property, the revised specification becoming effective in July, 1931. The research and standardization committee of the association continued its work on the testing of wire-bound boxes and crates, the designing of new packages intended to improve the manufacturing standards of the industry, and the development of new uses and more efficient designs. This committee, in conjunction with the Forest Products Laboratory of the U. S. Department of Agriculture, collaborated in the development of standardized methods of construction applicable to wire-bound containers and the determination of new manufacturing processes covering the thickness of veneer required for various types and weights of commodities, position of staples, and placing of binding wires.

World Calendar Association (Inc.), Elisabeth Achelis, president, 485 Madison Avenue, New York, N. Y. The world calendar, a revised calendar which retains the present 12 months, but is balanced in structure and perpetual in form is being sponsored by this association. The year is divided into four equal quarters, each consisting of three months, the first of which has 31 days, and the remaining two 30 days each.

Writing Paper Manufacturers Association, E. H. Naylor, secretary, 95 State Street, Springfield, Mass. In the standard "trade customs" adopted by this association are incorporated the standard stock sizes of bonds, ledgers, and writing paper set forth in a simplified practice recommendation issued by the Bureau of Standards.

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