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R. P. LAMONT, Secretary

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GEORGE K. BURGESS, Director

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DEPARTMENT OF COMMERCE,
NATIONAL BUREAU OF STANDARDS,
Washington, November 22, 1930.

SIR: I have the honor to submit herewith for publication the fifth 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 National 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 transport. 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.

There is also included in this issue a bibliography of recent publications relating to standardization, contributed by courtesy of William Adams Slade, chief division of bibliography, Library of Congress.

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 National Bureau of Standards.

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

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STANDARDS YEARBOOK, 1931

I. STANDARDIZATION IN TRANSPORT—A SYMPOSIUM

INTRODUCTION

Transport is a fundamental industry. Its scope embraces all means of motion in which passengers, material, power, and communications are moved from one place to another.

The fact that modern civilization involves a complex interlocking time schedule of operations necessitates a standardization with respect to time, place, speed, rates, and carrying capacity to meet predetermined schedules. In turn, these schedules affect profoundly the travel and transport of persons and things, and the operations of commerce and industry.

Those familiar with the vast extent of such standardization in transport facilities and operations, of course, realize that a symposium can touch only lightly some of the more important aspects of transport standardization.

To include communication of ideas, pictures, and power is a natural step quite consistent with the extension of the transport idea to include elevators, balloons, submarines, and belt conveyors. In industry the local materials handling enterprise is a miniature of the railroads, of the ship loading crane, and of other facilities of large-scale outdoor transportation. Elevators have, indeed, become in the larger buildings a problem of transportation engineering quite comparable with that of a railroad.

The purpose of this symposium is to present briefly some of the standardization aspects of transport in the broadest sense. The airplane has brought all degrees of freedom of movement of man and things. The radio and wireless have made communication instantaneous. The tractor rides roughshod through an unbroken forest or across untrod terrain. The distinct trend is toward a standardized transport service for everything which can be moved and to make such facilities universal. Indeed, this century has made it possible to bring transport facilities to the door of every home with a great quickening of social intercourse and a notable enrichment of human life.

The articles in this symposium range from general descriptive bird's-eye views to the detailed specific examples of standardization in the transport field.

STANDARDIZATION IN AERONAUTICS

By CLARENCE M. YOUNG, *Assistant Secretary of Commerce for Aeronautics*

Standardization and uniformity are ultimate results of careful planning, consistent action, and unity of thought toward the achievement of a definite goal. The elimination of mistakes and sometimes

costly errors are results of uniform policies and plans of procedure. Standardization of procedure is recognized as being the most practical and economical plan in nearly all activities concerned with repeated action.

The formulation of definite rules and policies for guidance in activities where repetition is involved aids in eliminating false steps and fallacious courses, which are costly both in their consumption of time and in their effect upon policies of sound economics. In attempts to exclude these evils, standardization has become one of the most valuable assets to business and other organized activities.

Aeronautics, being one of the newest industries, offers untold possibilities for the establishment of standard practices. As a new industry, it is inevitable that a few unsound and uneconomical practices may creep in without warning in some of its many phases. Many of these evils can be eliminated by standardization, which most certainly has a definite place in the field of aeronautics.

Standardized methods are needed for the guidance and assistance of the new industry as it grows in order to bring about sound economic practices and to exclude unwarranted mistakes. The trial and error method has no permanent place in established industry, and aeronautics, although still young, may definitely be placed in that category.

The necessity for standardization in aeronautics is becoming more and more apparent. The airplane has abolished boundaries of travel. In the period before the advent of the locomotive and automobile the distance which could be traveled in a day was measured in tens of miles. To-day it is measured in thousands. It is possible to fly across the country in less time to-day than it took to travel 100 miles in the days before fast means of transportation came into existence.

With a full knowledge of the necessity of standardization, the Aeronautics Branch of the Department of Commerce has carefully planned its work along well-defined and clearly-outlined courses of action. It employs standardization in its establishment and maintenance of airways, rules and regulations governing air traffic, and in its requirements for the construction and operation of aircraft and engines, in its licensing of pilots and planes, in its operation of communication systems along the airways, and in nearly all of its other activities. These functions of the Aeronautics Branch are carried out by specific methods, with the result that confusion and unwarranted consumption of time and money have been eradicated.

The Aeronautics Branch proceeds through the use of standard plans in the establishment of its airways from the time that the survey is made until the last intermediate field is lighted and ready for operation. It has also standardized its operation and maintenance of the airways after they have been established. It has formulated certain plans of action and policies to follow which have resulted in uniformity throughout. It employs the same type of equipment on all of its airways and operates them all in an identical manner.

In the establishment of the Federal airways system standardization has been definitely chosen as an ally—a choice which has been well justified.

This choice has resulted in the establishment of 15,000 miles of airways, uniform in their equipment, so that an airman who has used the airways in the eastern portion of the United States will find

airways nearly identical in nature and operation in the Western States. He will find the same type of 24-inch, 1,000,000-candlepower beacon light every 10 miles. He will find the same general type of intermediate landing field every 20 or 30 miles with the same type of equipment in the State of California that he found in New York. All intermediate fields are built according to standardized plans. They all are marked with a 50-foot white circle at the intersections of the runway center lines, with white panels 20 feet long and 2 feet wide extending from the outside of the circle along the runway center lines to indicate the landing directions. The lighting is uniform on all intermediate fields; consisting of boundary lights, a beacon light, course lights, range lights, obstruction lights, and illuminated wind indicator. A standard 24-inch revolving beacon is provided at each field, with the exception that in mountainous or isolated regions it is sometimes necessary to install electric or acetylene beacons. The airman may expect to find the fields lighted and marked in an identical manner for landing either by day or by night.

The airman will also find the same type of service rendered by the automatic telegraph typewriter circuits—furnishing him with the same type of weather information in all parts of the country. The radio-communication stations and equipment which are used for the broadcasting of the information gathered for him by the automatic telegraph typewriter circuits are standardized to a very high degree; they are even housed in buildings which are built to standards.

The standardization has resulted in features of safety and reliability which have been justified on many occasions. It has made it possible for air transportation—both scheduled and private—in nearly every section of the country to proceed over the Department of Commerce airways in as regular and uniform a way, as do automobiles over arterial highways.

The procedure employed in establishing and maintaining airways has been carefully planned and the work is divided among different units of the airway division, as follows: Survey, weather and communications, construction, and radio.

The survey unit determines airway routings, selects sites for beacons and landing fields, and concludes all negotiations for licensing these sites and for conditioning the fields for use by aircraft. The construction unit arranges for the purchase and shipment of all lighting equipment and supervises its erection and installation under contract or by airways division field forces. The weather and communications unit selects, establishes, and supervises the operations of airways weather reporting stations and airways communication stations. The radio unit designs, procures, and supervises the erection and installation of radio equipment for communications stations and radiobeacons. All units have definite methods and standards to guide them.

Standardization is employed in the regulation of aeronautics to protect the flying public and the aeronautic industry by obviating as far as possible insufficiently trained pilots and unairworthy aircraft.

All of the regulatory functions of the Aeronautics Branch are coordinated under the director of air regulation. The director of air regulation and his staff are primarily concerned with the construction and operation of civil aircraft in all its phases.

By determining and enforcing definite standards of safety this organization has established and maintained public confidence and thereby played an important part in the phenomenal growth of air commerce and of the aircraft industry.

This work includes the inspection and approval of airplanes and flying schools; the examination and licensing of pilots, mechanics, and flying-school instructors; and all field work in connection with engineering inspection.

The Aeronautics Branch has standardized its licensing of pilots to the extent that certain requirements must be met before the license is issued. Before the student is allowed to take instruction it is required that he pass a physical examination and procure a student permit.

An airplane to be eligible for general commercial use shall comply with the airworthiness requirements of the Air Commerce Regulations, which constitute a set of rules embodying requirements for structurally airworthy aircraft which serves as a guide to the aircraft industry as to what will be required on new designs.

The manufacturer submits to the Aeronautics Branch the design of the aircraft he proposes to build. When this design has been approved the manufacturer is required to present for inspection an aircraft built to that particular design. The aircraft itself is not only examined to determine if it is built according to the design submitted, but it is also checked for details in design, workmanship, and materials to see that certain standards of airworthiness have been complied with. The aircraft is then weighed and thoroughly flight-tested to make sure that it satisfies the stability requirements of the Aeronautics Branch. Even the factory is inspected to determine whether it is suitably manned and equipped to produce aircraft similar to the design submitted.

When the Aeronautics Branch has decided that its requirements have been fully complied with, the manufacturer is issued an approved type certificate which entitles him to build aircraft of exact similarity to an approved model, which are then eligible for commercial licenses, so long as the workmanship, materials, and design are adhered to according to required standards and are found by periodic inspection to be in airworthy condition.

The Air Commerce Regulations provide that all airplanes engaged in interstate commerce shall be equipped with power plants of a type approved by the Aeronautics Branch. Although there are no standard requirements as to weight per horsepower, or fuel or oil consumption per horsepower-hour for these engines, they are required to meet certain standards of design, material, workmanship, and performance.

Before engines are approved they shall demonstrate their efficiency by actual test. Principal among the tests to which each individual type of aircraft engine is subjected by the Aeronautics Branch is a 50-hour "endurance" run. This test is run off in 10 different periods of five hours each. Before the engine is submitted to the Aeronautics Branch for test it shall have been run for at least 25 hours by the manufacturer.

In a continuation of its policy of supervising aircraft for the protection and safety of those who use them, the Aeronautics Branch has placed in effect air traffic rules governing the operation of aircraft. These rules, which form a part of the Air Commerce Regu-

lations, shall be complied with by all aircraft, licensed or unlicensed, whether flown privately or engaged in interstate or intrastate commerce, and at all times. The Air Traffic Rules form a standard of requirements for the navigation, protection, and identification of aircraft and include rules as to safe altitudes of flight and rules for the prevention of collisions.

Realizing that a suitable, economical, and comprehensive plan for the radio requirements of aviation should be adopted, certain frequencies have been set aside solely for the use of aircraft, and rules governing their use have been placed in effect.

For the purpose of surrounding air lines engaged in the scheduled transportation of passengers in interstate commerce with all possible safeguards and with the view of providing air transportation with virtually the same uniformity of operation as is now enjoyed by the major railroads and steamship services, the Department of Commerce has prepared and promulgated a supplement to the air commerce regulations requiring the operators of scheduled air-passenger transport services in interstate commerce to obtain from the Secretary of Commerce a certificate of authority to operate such service.

The certificate of authority is issued only to those operators who effect complete compliance with the regulations and in the interpretations thereunder. These regulations constitute a standard or code of minimum requirements governing the operation of scheduled interstate air-passenger routes and are expected to bring about unprecedented records of safety and reliability in this phase of civil aeronautics.

These requirements specify, among other things, that aircraft shall be provided with suitable instruments and equipment; that they shall be adaptable to the nature of the service involved; that an adequate number of qualified airmen be employed; and that the equipment be maintained in a certain manner.

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 pilots, the Aeronautics Branch has organized a special research committee to study such systems. This committee is making a comprehensive study of the subject and will report its findings and recommendations.

The Aeronautics Branch is encouraging the adoption of uniform laws by States in order that the requirements to be met by aircraft and their operators will be the same throughout the United States. The adoption of uniform State laws will go a long way toward developing and simplifying the operation of aircraft on a nationwide basis.

In an effort to bring about uniformity in airport field rules throughout the United States, the Aeronautics Branch has prepared a set of suggested rules for adoption by owners of airports and landing fields. The uniform field rules have been printed in bulletin form and have been given wide distribution.

Standardization is also employed in the classification and approval of schools giving instruction in flying, which are classed as flying schools, ground schools, or ground and flying schools. These schools are examined and rated by the Aeronautics Branch upon application.

The Aeronautics Branch endeavors to bring about a certain amount of standardization in the design and construction of airports. Under its Airport Rating Regulations, the department will rate airports, on application, as to the general equipment and facilities, the effective landing area, and the aeronautic lighting equipment. The ratings are designated by symbols, such as "A1A," which is the highest rating given. However, the regulations set forth the minimum requirements for each rating, and, hence, it should be borne in mind that airports limited to the requirements for an "A1A" rating will not necessarily be adequate to meet the needs of every community or service. In addition to bringing about a certain amount of standardization in the design and construction of airports, the rating serves to indicate clearly to a pilot who is not familiar with the rated airport, the extent of the facilities available.

Obviously, the adoption of standard practices has proved extremely beneficial in the activities of the Aeronautics Branch. The order, lack of confusion, and the absence of complexities in the execution of its many functions are due in a large part to the early realization of the need for well-defined policies, plans, and programs of action.

The merits of standardization are well demonstrated in the thousands of miles of airways established by the Aeronautics Branch which have helped to make it possible for air transport to be operated over 100,000 miles on schedule every 24 hours, safely and reliably, and for aircraft employed in private and miscellaneous operations to be flown untold thousands of miles in safety. They are again shown in the great degree of airworthiness attained in present-day aircraft, in the efficiency of power plants, and in the competency of pilots.

As the aeronautic industry continues to grow, standardization will play an ever-increasing part in the development of sound business practices and in the elimination of waste.

STANDARD FORECASTS FOR AIR AND MARINE NAVIGATION

By C. F. MARVIN, *Chief, Weather Bureau, United States Department of Agriculture*

The standard forecasts and warnings of the Weather Bureau are based chiefly on simultaneous observations of local weather conditions taken and telegraphed from a network of representative stations in the continental United States. They are supplemented by weather messages obtained from ships at sea and by interchange with other national services. The standard observations are taken at 8 a. m. and 8 p. m., seventy-fifth meridian time, and the general forecasts of the bureau for aerial and marine navigation are based upon weather maps prepared by charting these reports. Observations at intermediate hours form a basis for special forecasts and warnings.

On May 1, 1930, the Weather Bureau began on 20 selected vessels the use of the new International Code for reports from ships at sea. This code was adopted at a conference of the International Meteorological Organization at Copenhagen in September, 1929. It is a figure code in standard forms and when in general use it will make possible transmission of reports from ships of any nationality to the meteorological service of any country party to the agreement. Adoption of this code is an important advance in the development

of forecasts for marine navigation and will obviate the necessity of numerous code books for translation of reports received, and the vessel master will be asked to send only one message in the standard form in place of several messages in a variety of codes.

There have been no material changes in the standard observations from land stations other than the addition of a word for visibility and height of ceiling ending the standard 8 a. m. and 8 p. m. message from selected stations.

The standard forecasts of the bureau are issued for fixed areas or districts. Since the forecasts are issued to cover a definite period in the near future, speed in transmission is essential. They are distributed over considerable areas and to be useful must arrive at destination in advance of the period of time covered in the forecasts. Brief messages are handled more rapidly, hence the standard forecast, in the smallest number of words in which it can be effectively presented, contains the essential features of weather expected for a given area.

Standard forecasts for marine navigation are of two types. General forecasts, based upon the 8 a. m. and 8 p. m. reports are issued for certain coastal and adjacent ocean areas. They embody in general terms the outlook for the weather during 24 hours in those regions. Hurricane, storm, and small-craft warnings are based upon the principal observations, or special observations obtained for the purpose. In the standard form they give the location of the disturbance, its probable direction of movement, intensity, and advise caution in certain regions when the disturbance is of such proportions as to endanger shipping.

Forecasts for air navigation are of three types. The general flying forecast is based upon the 8 a. m. and 8 p. m. observations and gives the weather outlook at the surface and in the free air during a 12-hour period in the standard aviation zones. Route or trip forecasts are issued for the benefit of air navigation along designated routes. In addition to these, there are standard 3-hourly summaries for designated airways, which contain information as to weather existing along the airways and forecasts for brief intervals ahead along comparatively narrow and limited air lanes.

Occasional forecast and informational service is furnished for transoceanic flying and the standard service for this type of air navigation consists of weather forecasts and summaries from the meteorological service of the country from which the flight originates, supplemented by advices from the meteorological service of the country in which the flight terminates.

STANDARDIZATION IN THE LIGHTHOUSE SERVICE

By G. R. PUTNAM, *Commissioner of Lighthouses, United States Department of Commerce*

It is probable that no organization has under its jurisdiction more diversified engineering activities than are found in the Lighthouse Service and in none is the need for uniformity more essential, for to the Lighthouse Service is delegated the task of safeguarding the water routes over which the ships of commerce travel, with the responsibility for human lives and merchandise.

Since the organization of the American Marine Standards Committee for standardizing various marine-construction details, the work has progressed steadily and about 100 different publications for standards of ship-construction details and fittings have been promulgated with the cooperation of the various shipyards and marine industries. These standards and others which are now in process of adoption will be of great economic benefit to the marine field. While their use is not mandatory, their adoption will simplify specifications and enable vessel owners to obtain the same class of construction or replacement in widely different localities, thereby producing uniformity in details which does not now exist generally.

The Lighthouse Service has found it increasingly evident that standardization has received the approval of many shipyards and the classification societies in that they are offering to use these standards in their designs. The Lighthouse Service desires to cooperate in furthering this work, which will eventually result in better and safer methods of construction.

There are many other ways in which the Lighthouse Service has found it possible to standardize its work. Several examples will be cited.

Certain types and sizes of buoys for use in all locations have been adopted, for the manufacture of which standard specifications are used. This results in a uniformity of design, which is necessary if confusion to shipping is to be avoided, and provides a standard of quality of workmanship for all contractors to follow and with which all inspecting officers are familiar. Drawings are made on standard-size sheets with standard title, standard forms of advertisement, proposal, instructions to bidders, and contract.

The distinctive coloring of buoys according to a prescribed standard has been in practice for many years, that item of standardization having been authorized by an act of Congress in 1850, so that passing up the coast or entering a bay, harbor, or channel, red buoys with even numbers will be passed on the starboard or right hand, black buoys with odd numbers on the port or left hand. On lighted buoys the light on the red buoys is red and on the black buoys white. It is desirable that reasonable uniformity in buoyage eventually be extended to embrace all maritime countries of the world, and an international conference on this subject is to be held this year.

In the field of radio marked progress toward standardization has been made by this service. Standardization of tube-type transmitters is being continued and has resolved itself into three major channels; the use of three general power ranges, the adoption of master oscillator power-amplifier circuits, and the clock control of apparatus. Power ranges have been divided into local low-power transmitters with output ratings not exceeding 10 watts, intermediate power stations with ratings from 100 to 200 watts, and primary stations rated at 500 watts. The use of master oscillator power-amplifier circuits is becoming more general, all new equipment being so designed, and considerable progress has been made in replacing and modifying other circuits in older equipment. Transmitters for such circuits are being built with all keying and control apparatus incorporated in the same frame and panel, greatly facilitating the replacement and duplication of apparatus. Clock control of radio-

beacons is in operation at a large proportion of the stations maintained by the Lighthouse Service, and, in addition, group synchronization of radiobeacons for conservation of frequencies and the reduction of interference has made much progress, about 40 per cent of the stations being so controlled.

When electric lamps in lighthouse lenses first came into general use many different shapes and sizes were purchased. The Lighthouse Service has now eliminated many of the sizes originally tried out and is confining its purchases to a small group which covers all the needs of the service so far as navigational purposes are concerned. This procedure follows closely the program of standardization carried out by the lamp manufacturers, who have discontinued many types and sizes.

Lighthouse lenses have also been standardized. All lighthouse lenses are classified according to orders or sizes, and a moderate number of different sizes supplies all the needs of the service.

The steel towers for minor lights throughout the service are standard, and it is now possible to procure such a skeleton tower for the height required, using the same drawings and specifications for all.

The benefits from the use of the standards already adopted are important. Not only are substantial economies in the initial cost and future maintenance of engineering equipment effected but the efficiency is materially increased.

STANDARDIZED DATA AND CHARTS FOR WATER TRANSPORTATION

By G. W. LITTLEHALES, *Hydrographic Office, United States Navy*

The nautical chart holds the primacy for the aggregate of its influences in promoting the security of the shipping engaged in the sea-borne commerce of the world and safeguarding the lives of seamen. No cargo is ever exported or brought home without its fostering aid. It is a miniature representation upon a plane surface, in accordance with a definite system of projection or development, of a portion of the navigable waters of the globe, generally including the outline of the adjacent land together with the surface forms and artificial features that are useful as aids to navigation, and always setting forth the depths of the water, especially in the near approaches to the land, by soundings that are fixed in position by accurate determinations. Except in charts of localities so limited in extent that the curvature of the earth is inappreciable on the scale of construction, a nautical chart is customarily framed over with parallels of latitude and meridians of longitude, in relation to which the features to be depicted on the chart are located and delineated, and the mathematical relation between the meridians and parallels of the chart and those of the terrestrial spheroid determines the method of measurement to be employed on the chart and the special uses to which it is adapted.

From a deep-rooted origin in the maritime world the Mercator chart—resulting from the development upon a plane surface of

an enveloping cylinder tangent along the Equator on which the features of the earth have been projected in such a manner that the track of a ship as long as she pursues the same true course will appear upon the chart as a straight line—has become the universal standard in nautical usage, rendering mutual understanding in the use of charts in navigation among mariners comparable to that which is realized with respect to numbers by having universally in current use a certain character to represent a given number of units. International usage has not yet attained to the stage of strict uniformity in regard to the conventional signs and symbols employed in charts to portray natural forms and artificial structures, but rather has it reached a stage of similarities among these conventional signs recognizable for the purpose of reading the information represented by the chart.

Nautical charts all have the fundamental characteristic of indicating the hidden dangers to be avoided by mariners and the channels where safety is to be sought in the guidance of shipping. Their numbers reach thousands and thousands, and they are all graded in their design and execution to suit the needs of those who need the sea—to tell the seafarer when there is a favoring tide and by how much his compass declines from the true meridian and where his safety is beset.

The data gathered in the marine hydrographic surveys from which charts are made serve also to supply supplementary descriptive information of advantage in piloting and the practice of navigation, which is embodied in manuals of sailing directions to accompany the charts.

The advance toward standardization of data for water transportation extends also to the descriptive lists of lighthouses and beacons and the register of radio stations and sea marks maintained in aid of navigation, which are issued by the hydrographic services of the maritime nations. These national services are associated together in the International Hydrographic Bureau at Monaco with the aim of endeavoring to obtain uniformity in hydrographic documents and of coordinating effort for rendering navigation easier and safer in all the seas of the world.

STANDARD CHARTS FOR MARINE NAVIGATION

By Capt. R. S. PATTON, *Director, Coast and Geodetic Survey, United States Department of Commerce*

Of the four major classes of transportation, namely, rail, water, highway, and air, it can be said that the first mentioned is the only one which has reached real standardization. The highway is making rapid strides in that direction, but it will probably be many years before water transportation reaches the high degree of standardization the railroad now enjoys. It will be still longer in the case of the newest means of travel, that by air.

The question may well arise as to why water transportation, one of the earliest methods known to man, has not yet reached the degree of standardization of the railroad and that which we can foresee for the highway. One of the reasons would seem to be that the ocean

liner has no well-defined path to follow along the shortest practicable route such as has the express train or the automobile. Instead, on each of its journeys a new path must be determined and, under unfavorable conditions, this is seldom the shortest practicable route and quite frequently not the safest. If an automobilist passes a cross-road onto which he should have turned off, he is only slightly inconvenienced, but should the navigator at some critical point along his route, determine and steer an erroneous course, the result would undoubtedly be disaster with possible loss of life.

The principal aid to the navigator in keeping his vessel on the track which he desires to follow and on one which will avoid the numerous dangers that beset his path, is his chart. The extent to which his chart serves this purpose depends on the detail and accuracy of the information shown thereon and, in this respect, much is demanded by the present-day, scientifically equipped navigator.

When modern science rendered practicable the accurate measurement of the velocity of sound in water and developed echo sounding, it furnished the mariner with an extremely valuable tool. Without reducing the speed of his vessel it is now possible for him to have a continuous record of the depths over which he is passing. If the chart shows the configuration of the bottom accurately and in sufficient detail, these records can be used in fixing the position of his ship even under conditions which render other methods of no avail. On the other hand, if the chart does not portray a true contour map of the bottom, the position of his ship becomes uncertain. This uncertainty means greater precautions, slower voyages, delayed arrivals, and increased operating expenses. It can readily be understood then why it is that the development of echo sounding has accelerated the demand not only for more accurate and more detailed surveys, but also for the extension seaward of such surveys.

To accomplish the surveys necessary to furnish standard data for a modern offshore chart is not always a simple matter. For every practical purpose a sounding must be considered as having three dimensions. A measurement of depth is of value, not simply in proportion to the accuracy with which it was made, but equally in proportion to the accuracy with which we locate the point on the ocean's surface from which it was made. A group of accurate soundings plotted on the chart in their correct positions relative to each other will give an accurate indication of a submarine valley or any other characteristic feature suitable for use by the mariner as a landmark. The same soundings incorrectly placed with reference to each other may give a seriously erroneous picture.

Therefore, in order to bring our charts into keeping with the resources of modern science, it has been necessary to devise new and improved methods of surveying those extensive areas which lie out of sight of land, but still fall on the shelves which border our coasts. On the Pacific coast these methods have been well standardized, and rapid progress is now being made toward the completion of a new series of standard charts. On the Atlantic coast the standardization of methods has been somewhat slower, but this process is now reaching the final stage and we can foresee within a few years the same rapid progress that is being made on the Pacific coast.

STANDARDIZATION IN THE MARINE FIELD

By A. V. BOUILLION, *Secretary, American Marine Standards Committee*

The movement to bring about collective standardization in the marine field was initiated at a conference held at the Marine Exposition in November, 1922, under the auspices of the American Marine Association. Prior thereto standardization of ship fittings and equipment had been practiced only by individual shipbuilders, shipowners, and manufacturers, although attempt was made by the Emergency Fleet Corporation to establish some national standards in carrying out the war shipbuilding program. The conference was suggested by the Department of Commerce to discuss the possibility of simplification of practice and elimination of waste in the marine industry with the idea that waste in construction, maintenance, and operation of ships could be reduced through unification of design and specifications for numerous fittings, materials, and items of equipment susceptible to standardization.

A committee was appointed, which met at the Department of Commerce in December, 1922, and tentatively planned steps to form a permanent organization. Subsequent meetings resulted in the organization in June, 1923, of the American Marine Standards Committee, as a national association of marine and related interests, to be self-governed through the annual election, from and by the membership, of an executive board.

The field of activities comprises design, construction, and manufacture of hulls, machinery, equipment, and fittings for ships and port facilities and their maintenance and operation, particularly in relation to the merchant marine of the United States.

The objects are: (a) To encourage, promote, adopt, and promulgate standards, rules, or recommendations, to bring about simplified practice in the marine field; (b) to cooperate with any individual or group engaged in the study or promotion of simplified practice in fields of engineering, commerce, and industry here and abroad on projects affecting the marine industry.

At the outset the marine industry was at a low ebb and inclination was lacking to undertake the work at its expense. This was overcome through cooperation of the United States Shipping Board and the Department of Commerce. The former supplied a secretary and the Department of Commerce furnished office facilities, assistance, and incidental expenses for organization and administration. This arrangement has since prevailed and the results achieved have been made possible only through this governmental cooperation. However, all concerned have liberally responded to requests for data, technical service, travel expenses to meetings, and in some cases staff members of various organizations have devoted much time to the work.

Most of the members of the original committee have been repeatedly elected to the executive board. This has made possible a continuity of policy conducive to good progress.

The technical activities are carried on under the direction of technical committees. The secretary's office is the clearing house and correlating center for the administrative and technical activities. Four technical divisions have so far been organized, viz, hull details;

engineering (machinery) details; ship operation details and supplies; port facilities, each of which is headed by a technical committee, the members of which are recruited at large independently of the membership. The governing rules are flexible and permit simple procedure under all circumstances.

The subjects dealt with are greatly diversified as may be noted from the following:

Hull Construction and Fittings.—Air ports; fixed lights; mooring bitts; cargo booms and fittings; rigging details; scuppers and drains; marine glue; rat proofing of ships; chocks; mooring pipes; locks and other joiner hardware; fittings for oil-tight hatches; water-tight doors; sockets for hatch beams; ventilation cowls and fittings; cleats; ladders and gratings; cargo handling gear; steel specifications; standard shapes for ship construction.

Ship Machinery.—Insulation methods and materials; propellers; shaft details and accessories; condenser tube ferrules, tube sheets and metallic packing; refractory materials; pressure and vacuum gages; boiler materials; flanged pipe fittings and pipe flanges; water-tight electrical receptacles; machinery spare parts and supplies for sea-going ships.

Ship Equipment.—Fire and other hose; medical and surgical outfits; textiles; safety equipment and methods; table glassware, chinaware, and silverware; pilot ladder; sizes and general requirements for lifeboats; lifeboat disengaging apparatus; fire-hose racks; wire ropes; metal frame berths and accessories.

Ship Operation, Care, and Upkeep.—Operation, care, and upkeep of boilers and machinery; care and maintenance of steel hulls; distinctive markings for piping; care and operation of oil-burning apparatus and handling of fuel oil; uniforms for merchant marine officers.

Ship and Machinery Design.—Loading and stability of ships; rules for design and construction of boilers and pressure vessels.

Port Facilities.—Bollards and cleats for docks; reinforced concrete piles for wharves and piers; structural-steel cargo masts for docks; platform cargo slings.

Most of the subjects mentioned are covered by standards already promulgated. Others represent current work.

The economic benefits to accrue from the committee's work are widespread, but may be summed up generally as follows:

To Naval Architects and Marine Engineers.—Simplified plans, specifications, and bills of materials by reason of standard materials, methods, fittings, and appliances.

To Shipbuilders.—Simplified planning, purchasing, shop orders, and shop tools and methods; economy in producing or purchasing standard fittings and equipment; less stock by reason of fewer varieties; less storage space for patterns and stores; reduced dead investment and consequent savings in overhead expenses; saving in time of construction by simplified operation.

To Ship Operators.—Simplified purchasing, longer life of fittings and equipment due to improved design and specifications; simplified operation by standardized methods; decrease in maintenance work; time saving in repairs and renewals; reduced stores for replacements; increased efficiency and safety.

To Manufacturers.—Possibility of mass production; simplified shop practice; less stock of raw materials; savings in stores and tools and their storage; quicker handling of orders.

To Ship Repair Plants.—Work simplified by standardized fittings, materials, and methods; less stock by reason of fewer varieties; less storage space; time saved; operating expenses reduced.

PRECISE CONTROL OF DIMENSIONAL STANDARDS IN THE MANUFACTURE OF AUTOMOBILES

By C. E. JOHANSSON, *Engineering Laboratory, Ford Motor Co.*

In the early stages of the automobile industry, parts were made to fit certain master gages or templets rather than to specific dimensions, and were interchangeable only in a limited way. However, the demand for more accurate work and fully interchangeable parts, together with the fact that parts had to be manufactured in widely separated plants, made it necessary to manufacture the parts to specific dimensional standards.

The manner in which the precise control of the dimensional standards has been accomplished and the methods and means which are used therefor at the Ford Motor Co. will be described and set forth in this article.

1. ACCURACY IN CONTROL OF DIMENSIONS

Quite early in my research work, in the art of measuring dimensions of length, I came to the conclusion that, in comparison with earlier practice, it should be with necessary means only slightly or perhaps no more difficult to manufacture parts on a mass-production basis to dimensional standards with close limits without increasing the cost or decreasing the speed. This has now been proved at the factory where, in the production of the current model car, dimensional standards with limits of one ten-thousandth part of an inch are specified and maintained on several parts, with mass production heretofore unequaled.


The foundation for all precision measurements of length for our company is the Johansson combination block gages. The use of these standards makes possible the manufacture of gages, tools, and fixtures to specific dimensions and gives the inspectors a positive method of determining at any moment their condition, which is very important, as, one gage worn to the point where it does not check the specified limits properly may mean, in a one-hour run, several thousand defective automobile parts, stopping the operation of the assembly line or retarding the production activities of some branch in a distant part of the world. All close-limit gages are therefore checked every day and many as often as once every four hours.

The gage blocks are manufactured with the following degrees of accuracy:

| | | |
|-------------------|--|--|
| Working set--- | "B" ± 0.000008 (eight-millionths inch) | { Per block up to 1 inch and per inch of length on longer blocks. |
| Inspection set--- | "A" $\pm .000004$ (four-millionths inch) | |
| Laboratory set--- | "AA" $\pm .000002$ (two-millionths inch) | |

The inspection of working gages for wear is made with special size, standard design, Johansson gage blocks. These blocks are mounted with special design holders, in units of three, representing

the "minimum," "maximum," and "wear-limit" sizes. The wear-limit size on female gages has been determined as the sum total of the maximum limit plus 20 per cent of the total limit or difference between the maximum and minimum sizes. These special size gage blocks are checked for size with Johansson combination block gages, of which approximately 200 sets are in constant use at one of the plants. An average of 10 of these are sent each week to the engi-

|  CERTIFICATE of INSPECTION on JOHANSSON GAGE BLOCKS Issued by C. E. JOHANSSON, Inc. Division of <i>Ford Motor Company</i> Engineering Laboratory DEARBORN, MICH. | | | | ACCURACY (A ₁ 63° Fahrenheit) AA = .00002 inch A = .00004 inch B = .00006 inch per block up to one inch and per inch of length on longer blocks. | | | |
|--|-------------|-------------------------------|-------------------------------------|--|-------------|-------------------------------|-------------------------------------|
| PROPERTY OF FORD MOTOR COMPANY ROUGE PLANT WITT INSP. | | | | SET No. 1-B SERIAL No. 739 DATE 10-16-1929 | | | |
| SPECIFIED SIZE | ACTUAL SIZE | Variation From Specified Size | Recommended Replacements Accuracy A | SPECIFIED SIZE | ACTUAL SIZE | Variation From Specified Size | Recommended Replacements Accuracy A |
| 0.050" | O.K. | | | 0.131" | O.K. | | |
| 0.100 | O.K. | | | 0.132 | O.K. | | |
| 0.1001 | .100085 | .000015 | X | 0.133 | O.K. | | |
| 0.1002 | O.K. | | | 0.134 | O.K. | | |
| 0.1003 | .100285 | .000015 | X | 0.135 | O.K. | | |
| 0.1004 | O.K. | | | 0.136 | O.K. | | |
| 0.1005 | O.K. | | | 0.137 | O.K. | | |
| 0.1006 | O.K. | | | 0.138 | O.K. | | |
| 0.1007 | O.K. | | | 0.139 | .138985 | .000015 | X |
| 0.1008 | O.K. | | | 0.140 | .139988 | .000012 | X |
| 0.1009 | O.K. | | | 0.141 | O.K. | | |
| 0.101 | O.K. | | | 0.142 | O.K. | | |
| 0.102 | O.K. | | | 0.143 | O.K. | | |
| 0.103 | .102985 | .000015 | X | 0.144 | O.K. | | |
| 0.104 | O.K. | | | 0.145 | O.K. | | |
| 0.105 | .104985 | .000015 | X | 0.146 | O.K. | | |
| 0.106 | O.K. | | | 0.147 | O.K. | | |
| 0.107 | .106988 | .000012 | X | 0.148 | .147988 | .000012 | X |
| 0.108 | .107280 | .000020 | X | 0.149 | .148985 | .000015 | X |
| 0.109 | .108985 | .000015 | X | 0.150 | O.K. | | |
| 0.110 | O.K. | | | 0.200 | O.K. | | |
| 0.111 | O.K. | | | 0.250 | .249988 | .000012 | X |
| 0.112 | .111985 | .000015 | X | 0.300 | O.K. | | |
| 0.113 | O.K. | | | 0.350 | O.K. | | |
| 0.114 | O.K. | | | 0.400 | O.K. | | |
| 0.115 | O.K. | | | 0.450 | O.K. | | |
| 0.116 | O.K. | | | 0.500 | .499985 | .000015 | X |
| 0.117 | O.K. | | | 0.550 | O.K. | | |
| 0.118 | O.K. | | | 0.600 | O.K. | | |
| 0.119 | O.K. | | | 0.650 | .649985 | .000015 | X |
| 0.120 | O.K. | | | 0.700 | O.K. | | |
| 0.121 | .120985 | .000015 | X | 0.750 | O.K. | | |
| 0.122 | O.K. | | | 0.800 | O.K. | | |
| 0.123 | O.K. | | | 0.850 | O.K. | | |
| 0.124 | O.K. | | | 0.900 | .899985 | .000015 | X |
| 0.125 | .124988 | .000017 | X | 0.950 | O.K. | | |
| 0.126 | O.K. | | | 1.000 | .999980 | .000020 | X |
| 0.127 | O.K. | | | 2.000 | O.K. | | |
| 0.128 | O.K. | | | 3.000 | O.K. | | |
| 0.129 | O.K. | | | 4.000 | O.K. | | |
| 0.130 | O.K. | | | | | | |

THE MEASUREMENTS ARE TAKEN IN THE CENTER OF THE MEASURING SURFACES.
Gage blocks marked O. K. are within original accuracy at 63° F.

INSPECTED BY: **ATLIE JANSSON**

REMARKS: X NEW BLOCKS = 19 pcs.

C. E. JOHANSSON, Inc.
Division of
Ford Motor Company
C. E. Johansson

FIGURE 1

neering laboratory for inspection and if necessary, replacement by the Johansson division. When a gage block in the working set (eight millionths inch accuracy) shows wear of more than ten millionths of an inch (0.000010") under its nominal measuring value, it is discarded and replaced with a new gage block of the same nominal size. In other words, the working sets of Johansson gage

blocks used on the current model car are kept accurate within ten millionths of an inch, and when they exceed that limit they are discarded.

Figure 1 is the reproduction of a certificate of inspection which illustrates how the working set "B" of Johansson gage blocks is inspected and kept within the limit of ten millionths inch accuracy. These sets are used to check and ascertain dimensions of length on gages, tools, and fixtures in the tool and inspection departments and to certify the accuracy and setting of amplifiers, micrometers, and measuring instruments throughout the factory.

The set "A," with an accuracy of four-millionths of an inch, is inspected and kept within a limit of six-millionths of an inch. These sets are used to check and ascertain dimensions of length on gages, tools, and fixtures that have exceptionally close limits and to make sure that they are within the specified limits of accuracy.

The laboratory set "AA," with an accuracy of two-millionths of an inch, is kept within the limit of three-millionths of an inch. This set is used to check and set measuring machines and other fine instruments that are used in the factory gage inspection department.

When a gage block in the inspection sets wears more than six-millionths inch (0.000006) under its nominal measuring value and the wear is less than ten-millionths of an inch, it is used to replace a worn gage block of the same nominal size in a working set. The same procedure is followed with worn gage blocks in the laboratory sets where blocks with more than 0.000003 inch and less than six-millionths inch wear under the nominal size are placed in the inspection sets.

This allows a wear limit on "B" blocks of 0.000002 to 0.000018 inch; on "A" blocks of 0.000002 to 0.000010 inch and on "AA" blocks of 0.000001 to 0.000005 inch.

2. SIGNIFICANCE OF UNIFORM MEASURING TEMPERATURE

During the time between the years 1896-1906, while working out the details and methods on my first sets of combination block gages I discovered that it was very important to maintain a constant temperature when adjusting and measuring the block gages. I also determined that the best results were obtained with a temperature of 20° C. (68° F.) in the adjusting and inspection rooms. As my block gage sets became better known and in more general use in different manufacturing plants I urged, in order to get better results, that parts or gages to be measured be brought to the same temperature as the block gages and this temperature to be 20° C. (68° F.). In cases when limits on parts were not too close and the above ideal condition could not be obtained, means should at least be provided for bringing the parts and gages to the same temperature.

The exceptionally close limits specified on the present model car were such that it was found difficult or nearly impossible to get the desired results on the more important parts, such as piston pins of hardened steel; pistons of aluminum; connecting rods made of steel and bronze, due to the difference in metals and the different coefficients of expansion.

To overcome these difficulties we then followed a method heretofore used only for adjusting and measuring high-grade precision gages and tools, namely, measuring in constant temperature rooms. At one of the plants there were constructed four rooms inclosed by double walls. These rooms were placed in the production line and conveyors moved in and out of the room, carrying parts to be measured. The temperature of these rooms is maintained at 68° F. and parts are kept in the room long enough to take the same temperature before they are inspected. With the erection and operation of these constant-temperature rooms, all difficulties on measurements of length were eliminated and specified sizes can now be maintained to precise dimensions.

The difficulties overcome can be better understood from data on experiments before the constant-temperature rooms were installed and put into operation.

It was found that 13° F. added to the normal temperature of 68° F., a total of 81° F., increased the size of the connecting rod 10/100,000 inch; the piston 20/100,000 inch, and the piston pin 10/100,000 inch; and a total temperature of 90° F. increased the size of the connecting rod 14/100,000 inch, piston 33/100,000 inch, and piston pin 15/100,000 inch.

By using the latest and most-modern measuring instruments with the Johansson combination block gages as the foundation measurement, in constant-temperature rooms at 68° F., it is now possible to maintain and control the dimensional sizes of machine parts with utmost precision.

STANDARDS FOR INTERSTATE COMMON CARRIERS

By T. A. GILLIS, *Acting Secretary, 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. All such carriers are required to file annual, monthly, and quarterly reports, and the commission publishes the results in 25 series of publications. These statistics record the growth, the technical progress, and the financial condition of these industries. Freight commodity statistics published show the tonnage carried for each of 157 varieties of traffic. Such data over a period of years have a bearing on the discussions of the future of the railways, and will answer whether traffic has reached a static condition or will continue to grow and demand added facilities and new capital in the future as in the past. Monthly wage statistics picture the hours worked and compensation of 148 classes of employees, and are much used in adjustment of wage disputes by the United States Board of Mediation. The comparative statement of operating averages exposes to view the operating performance of each railway by means of averages for a series of years dealing with the maintenance of way and of equipment, and with the performance of locomotives, cars, and trains. An annual accident bulletin is pub-

lished, containing a detailed classification of the causes of accidents. Less detailed statistics are published concerning carriers by water, telegraph, and telephone companies, pipe-line companies, and electric railways.

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, interchange, and return of locomotives, cars, and other vehicles used in the transportation of property. Such standardization of railway operating practices make 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 standardization 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 consistently 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.

STANDARDIZATION ON RAILWAYS

By W. C. CUSHING, *Engineer of Standards, the Pennsylvania Railroad*

To the railways standardization means the economical purchase and use of materials, tools, appliances, and supplies.

To the industrial manufacturing establishments it has the signification of mass production. The entire train of operations is mechanized and standardized, and elimination of waste the effort of constant watchfulness.

In both services it is unified practice.

In the resulting efforts of studious technical associations, lacking organization authority, it becomes recommended practice.

In the semiaccomplishment of reduction in variety and numbers for selection it becomes simplified practice.

Industrial Standardization, published by National Industrial Conference Board (Inc.), New York, 1929, stated:

It is a widely known fact that the average consumer's knowledge of market values is so hopelessly inadequate that a persistent sales campaign can make him believe almost anything. The greater the multiplication of varieties, sizes, and terms, the worse his confusion becomes.

Standard practice is expressed by:

1. Specifications.
2. Plans in more or less complete detail.
3. A code of instructions or rules (Railways' Book of Rules).
4. A selected list of suitable materials or articles, similar and equalized.

Specifications are a description of the article, appliance, device, or material desired, together with methods of examination and proof testing for ascertaining their compliance with the requirements.

They are prepared in such form that they can be used in the regular routine of office work and avoid the necessity for dealing with each new request as though it were a new subject, thus clogging the working machinery and limiting the effectiveness and range of accomplishments of the daily task.

When rightly prepared they save time and dispose of a problem so that it will be dealt with without delay in a routine way through systematic prescription covering all the steps to be taken.

Specifications should be prepared so that:

1. They will inform the purchasing agent of the kind and quality of the article required.
2. They will instruct the manufacturer upon the terms and conditions, in precise statement of desired attainments, which will be proof tested in the manner described for checking the fulfillment.
3. They will inform the inspector of the purchaser of the conditions of purchase, manufacture, examination, and proof testing so that he will be the final authority for acceptance for the purchaser.
4. They will keep at hand conveniently for the ready reference of the engineers charged with the preparation of specifications, and of those who use the articles, appliances, devices, or materials a statement of the details of preparation in each case. Convenient in-

formation of this kind saves time in searching elsewhere, when the multiplicity of articles required for construction and maintenance is borne in mind. To many of them they are desirably instructive.

It would be impossible for a busy officer offhand to state clearly and precisely the description necessary for the purchase of the hundreds of things required daily.

When the description of the article to be purchased involves the general physics, that is, the science of forces or forms of energy of inorganic nature, the research laboratory becomes the valuable instrument for the study of the mechanics of materials and of applied chemistry in the arts and manufactures. These research and proof-testing laboratories have become the fundamental basis for maintaining the integrity of materials, tools, and machinery upon which the safety of the vast transportation business depends.

Approachment in perfection of specification writing leads to a wider field of usefulness, and the resultant acceptance as a national standard. For this accomplishment, the cooperative assistance of the manufacturers is desirable and necessary. The active agencies for bringing about this result are in many cases the engineering societies and the associations of manufacturers. In this way the specifications for crossties have been made a national standard, and in like manner it is expected that the principal features of track bolts will become a national standard. Much work of this kind is in progress, notably the effort to nationalize the specifications for bridges.

Standardization by the railways began probably by the elimination of odd gages for tracks. Then followed the necessary unification of interchange dimensions for rolling stock, September 19, 1866.¹ Then occurred, in 1875, the general-time convention, which worked out the plan for standard time in the United States in 1883, without which it would be difficult to adhere to the transportation regularity of the present time. The name of this group of railway organizations was changed to American Railway Association in 1891,² since which time it has been enlarged by the incorporation of technical railway associations, and is the influential central agency of the railways for mutual standardization.

Specifications are thus a standardized description of the article to be purchased, but the utmost vigilance must be at hand for the revision made necessary by the increased severity of the use.

Frozen standardization is an enemy to be avoided.

Mobile standardization is the friend and assistant of well-organized business, the fundamental unit of which is the transportation industry.

STANDARDS IN AUTOMOTIVE RESEARCH

By DR. CHARLES F. KETTERING, *President General Motors Research Corporation*

The standards used in the automotive industry are largely based on experience. Research work, on the other hand, looks to the future, and generally is an effort to escape from, or improve upon, existing standards. Nevertheless, the standards have been influenced profoundly by research work. If we had the facilities and the patience,

¹ *Railway Age*, p. 1423; June 22, 1929.

² *Proc. Am. Railway Eng. Assoc.*, **30**, p. 78; 1929.

we probably could trace every specification back to fundamental experiments conducted by some one at some time. Such an activity would be very difficult, however, because of the length of time which elapses between experimental work and the general use of the results obtained. Matters which are the subject of research to-day probably will be, in many instances, standards of the future but not, however, until they have been proved and modified in service. The lacquer finish and the chrome plating used universally to-day each required about five years between initial experiments in connection with the automotive industry and general adoption. This is an unusually short time and perhaps an indication that the improvements were very much needed. A much longer time elapsed between the fundamental experiments and general adoption. Literature on the subject indicates that cellulose nitrates were known in 1845 and Bunsen worked with chrome plating in 1854.

Some of the standards may be termed "standards of necessity." It would not be possible, for instance, to make our vehicles very much wider, because our roadways would not accommodate them. Similarly, vehicles can not be made much lower, because even the best boulevards are at times rough and rutty with snow and ice.

It is entirely reasonable to believe that the automotive industry could not have attained its present economic and engineering status without standards. It is also important to note that most of the standards apply to relatively minor details. Any attempt to standardize the major factors of design would interfere with progress. People have their own ideas as to what their automobiles should do and how they should look. These wishes must be respected. If he prefers artistic elegance, that, too, must be forthcoming. Most present-day cars are compromises combining some measure of both of the qualities just mentioned.

Standards in use to-day have been formulated largely with a view to economy and manufacturing expediency and, in addition, to enhance the performance or permanence of the product. It would be entirely possible to make an operable automobile with a different thread for every bolt and screw. Cylinders and pistons would operate even if they were not all the same size. There are a vast number of possibilities with respect to spark-plug sizes, ball-bearing sizes, tire sizes, etc. Some such conditions existed in the early days of the industry, and the purchaser of repair parts required a vast amount of patience and perseverance as well as a very loose purse string. After a minor part, such as a lamp socket or fan pulley, has been designed and has been proved in service, there may appear to be no good reason for designing and proving something different. The continued use of such a standard not only saves time and expense in designing but also justifies installation of special equipment which, in turn, results in low manufacturing cost. In many instances, however, further experiments show that changes may be made in well-established designs that will produce additional economies in manufacturing.

It has been almost 20 years since the compositions of the steels commonly used in the industry were standardized. A few revisions and additions have been made from time to time. These specifications are not based entirely on commercial experience, but have been

the subject of many experiments and tests. Tensile strength, toughness, resistance to repeated stress, resistance to shock, etc., have been studied in many test laboratories on many occasions.

An ideal specification would admit all materials suitable for the purpose at hand, and exclude all else. Inasmuch as there generally is no sharp distinction between the suitable and the unsuitable, and because of uncertainties of inspection, many practical specifications are unnecessarily stringent. A better understanding of requirements and a better understanding of materials would do much toward remedying this undesirable situation. Much experimental work has been done in this connection and much more is needed.

STANDARDS FOR HIGHWAY AND TRAFFIC CONTROL

By C. W. STARK, *Assistant Manager, Transportation and Communication Department, United States Chamber of Commerce*

Standardization of highway and traffic control has been the subject of intensive study during the past six years, and much progress has resulted. The development of these standards has been effected largely by the National Conference on Street and Highway Safety under the chairmanship of the Secretary of Commerce with the cooperation of the national associations directly interested in the traffic problem, and the service in committee work of public officials and private citizens from every part of the country and representing every interest affected. The National Conference of Commissioners on Uniform State Laws has collaborated in the preparation of the Uniform Vehicle Code, and that body and the American Bar Association have indorsed the code.

From a general statement of desirable uniform principles adopted by the First National Conference on Street and Highway Safety in 1924, the plan of standardization has resolved itself into three parts—uniform State motor-vehicle legislation, uniform municipal traffic ordinances, and uniform street and highway-traffic signs, signals, and markings.

The first of these standards, the Uniform Vehicle Code, was drafted in 1926. It consisted of four acts—a uniform motor vehicle registration act, a uniform motor vehicle antitheft act, a uniform motor vehicle operator's and chauffeur's license act, and a uniform act regulating traffic on highways. This subdivision of the code recognized widely varying degrees of control of motor vehicle operations or need therefor in the different States, and made it possible readily to adopt parts of the code for which a given State was ready.

Act IV, that regulating traffic on highways, included certain basic rules of the road necessarily applicable to cities and towns as well as to the open country, but left the details of urban traffic control mainly to the individual municipalities.

The model municipal traffic ordinance was developed by a committee of the conference in 1928. The model ordinance repeated certain provisions of the State code applicable particularly to municipalities, but embraced mainly matters not covered in Act IV of the code, such as parking regulations and details of pedestrian control. It defined the meaning of traffic signs and signals and laid down certain conditions under which they might be erected, but did not provide engineering specifications for them.

In 1926-27 the American Association of State Highway Officials and the United States Bureau of Public Roads, recognizing the need for uniformity in highway signs and markers, through a joint committee prepared a manual for such signs and markers. Late in 1926 the American Engineering Council undertook the preparation for the national conference of a manual on street traffic signs, signals, and markings, and this was developed in harmony on the one hand with the above-mentioned manual for rural highway signs and markers and on the other hand with the requirements regarding signs and signals of the model municipal traffic ordinance. This manual, which involved study of installations and operations in more than 100 cities, was completed early in 1929.

In 1929-30, a committee of the national conference organized for the purpose, reviewed all of these standards and submitted them with recommended revisions to the Third National Conference on Street and Highway Safety held in May, 1930. These were approved by the conference with other revisions, and the amended Uniform Vehicle Code was approved by the National Conference of Commissioners on Uniform State Laws and the American Bar Association at their annual meetings in August, 1930.

A notable change made in Act IV of the Uniform Vehicle Code was the incorporation therein of a large part of the model municipal traffic ordinance. In the four years from 1926 to 1930 prevailing sentiment advanced from a belief that each municipality, large or small, must be allowed to control its traffic in accordance with its peculiar conditions, with a minimum of interference by State law, to one that the basic considerations in virtually all traffic matters except the details of parking restrictions and prohibitions are essentially the same in all communities and should be standardized by State law. The New Jersey Legislature took the lead in this direction in 1928 in its State law, and Wisconsin and New York followed in 1929.

Twenty-five States have adopted at least one act of the Uniform Vehicle Code or have revised their existing laws to bring them into closer harmony therewith. Pennsylvania, Delaware, and Arizona have adopted the entire code with slight modifications in some particulars. North Carolina, Virginia, North Dakota, Idaho, and New Mexico have adopted all but the operators' and chauffeurs' license act. Michigan, Wisconsin, Minnesota, Louisiana, and South Dakota have adopted the act regulating traffic on highways.

California, by successive revisions of its existing laws, has brought them into substantial harmony with the code. All of the New England and North Atlantic States with the exception of Maine and Delaware had operators' license laws with mandatory examination, in substantial harmony with the code, prior to the drafting of the code, and Delaware has since adopted the code. Maine, New Hampshire, New Jersey, Washington, and Oregon have brought their rules of the road into closer harmony with those of the code. Maine, West Virginia, South Carolina, Michigan, Indiana, Wisconsin, Nebraska, Washington, and Oregon have adopted license laws for drivers, but without the mandatory-examination feature deemed essential to the full effectiveness of the law. Numerous other States require licenses without examination for chauffeurs only.

In addition to all municipalities in New Jersey, New York, and Wisconsin, which are brought under the model municipal traffic ordinance by State law, some 30 or 40 cities have remodeled their traffic ordinances in substantial harmony with the model ordinance. The traffic authorities of an equal or greater number of cities have adopted the manual on street traffic signs, signals, and markings, while practically all of the State highway departments have adopted the manual for rural highways.

The National Conference on Street and Highway Safety has constantly emphasized the great importance of uniform standards for highway and traffic control, both from the standpoint of safety and that of expediting traffic. The motor vehicle has wiped out local and State boundaries, and variations in traffic rules inevitably result in misunderstanding, disrespect for the law, accidents, and chaos. Uniformity, with enforcement, means assurance and respect for the law for every motorist desiring to operate properly; it means orderly flow and the expediting of traffic—and it certainly offers promise of a stemming of the tide of traffic accidents with their appalling destruction of property and loss of life.

ELEVATOR STANDARDIZATION

By J. A. DICKINSON, *Research Associate, National Bureau of Standards*

The development of transportation equipment within the past half century is in a large measure responsible for the tremendous strides made in industry and the improved standard of living. This remarkable growth has been in no small measure due to standardization, both in methods of manufacture and in equipment. There is one form of transportation which, while its growth has been exceptionally rapid, has been to a large measure handicapped because of a lack of uniform standards. This is vertical transportation. Because elevators are used for public conveyance, they are very closely regulated in many States and cities. These codes have been largely drawn by local groups without regard to other existing regulations of similar nature.

An unfortunate angle to the present multiplicity of codes is the wide divergence of requirements for the same piece of equipment. For example, the factors of safety of hoisting cables may vary from 5 to as high as 12. If the factors of safety are too low, wear will be extremely rapid, and a cable which is apparently in fairly good condition at the time of inspection may fail before the next inspection, because it is operating at a stress high enough to cause rapid deterioration. Conversely, if the factor of safety is placed too high, the building owner may be penalized by being required to buy cables of too large a size at a price considerably above that of cables which would give adequate safety over a reasonable period of time. It might be said in passing, however, that in most cases factors of safety on elevator equipment have not been too high. In fact, in many cases, considering the nature of the stresses involved, particularly the impact stresses during starts and stops, such factors have been low in comparison with structural engineering practice.

This wide range in requirements for the same piece of apparatus has one exceedingly unfortunate commercial aspect. At the present

time there is, aside from the question of motors and controls, no real standardization in the elevator industry. When a contract for an elevator or a bank of elevators is placed it is necessary for the manufacturer to study most carefully the city or State regulations governing that particular installation, so that practically every job is built especially to meet local requirements. The question will naturally be asked, Why do not manufacturers build to a high enough standard to meet all State or municipal regulations? In the case of high-speed, high-rise passenger elevators this is done; that is, in many cases they build to factors of safety far beyond that required by many local codes and ordinances, and at the same time provide many safety devices or features that are not called for in the local code.

In the case of moderate and slow-speed elevators the manufacturer is probably in competition with other elevator builders, including local concerns, some of whom may be building principally on a price basis. Such a builder, using a factor of safety of 4 on a car frame, would have a marked advantage over a manufacturer doing a national business who would have established his own standards, using a factor of 7 for his cars. The latter will be much heavier, involving stronger cables, heavier counterweights, and a more powerful hoisting engine, all of which costs money. If a manufacturer doing a national business is to compete in a jurisdiction where such competition is encountered, he must build equipment comparable in price to that permitted by the local rules, which obviously will interfere with the standardization of his product.

In an endeavor to provide a standard code which might serve as a basis for State and municipal regulations, the National Bureau of Standards, the American Society of Mechanical Engineers, and the American Institute of Architects have assumed joint sponsorship, under the procedure of the American Standards Association, for, and have drawn up, through the medium of a suitable sectional committee, a safety code which is now the basis for a number of State and municipal regulations. If such a code is widely adopted, it will ultimately permit the commercial standardization of such equipment.

When the first revision of the code was prepared in 1925 it was evident that there was not available sufficient information regarding the performance of certain safety equipment to draw adequate code rules. The committee, therefore, decided to establish a research fellowship at the National Bureau of Standards to study the performance of such devices. Thanks to the whole-hearted cooperation of the industry, adequate financial support was assured, and the work started.

This research work which has been going on for approximately four years has developed engineering tests for oil buffers which have been included in the 1930 revision of the American Standard Safety Code for Elevators. Many manufacturers have taken advantage of the data obtained during these buffer tests which have been made during this period, with the result that buffers have been redesigned to give a performance which will meet these code requirements. Work is actively being pushed on the development of apparatus and equipment for testing undercar safeties. This preparation has included the design and construction of a high-speed camera capable

of photographing a very accurate metal tape at intervals of $1/60$ second and with an exposure as short as $1/25000$ of a second. From the time-travel record obtained from such a film velocity and retardation of the car under the action of safeties may be computed for any instant of its travel. The results of these tests should do much to improve the performance of such apparatus, and it is hoped that ultimate specifications for performance tests may be drawn up which will insure apparatus of adequate design for conditions apt to be encountered in the field.

Work of this kind supported by the entire industry will give engineering data which could not be obtained by any one company without the expenditure of sums far in excess of their individual contribution.

STANDARDIZATION IN TRANSPORT OF ELECTRICAL ENERGY

By WM. MCCLELLAN and R. H. BARCLAY³

Standardization in the transport of electrical power has made more rapid progress during the decade just past than in any of those preceding. Formerly most systems were operated as separate isolated units, each having some standards adapted to its own needs. With the advent of interconnection these problems peculiar to the isolated system, which previously had received only a small amount of general consideration, required reconsideration from the broader standpoint of their effect upon the enlarged system and this has furnished the added stimulus for more universal standardization.

The development of standards has been made possible largely through the cooperative efforts of the American Institute of Electrical Engineers, National Electric Light Association, and National Electrical Manufacturers' Association, representing, respectively, the engineering, operating, and manufacturing branches of the industry. These organizations have not only compiled a large number of standards in their own particular fields but in cooperation with others have assisted in the production of the National Electrical Safety Code sponsored by the National Bureau of Standards and the National Electrical Code sponsored by the National Fire Protection Association. The former deals largely with such factors as safety to life or property and the latter with the minimum electrical and mechanical requirements of electrical installations. Like all standards in an art which is still in a period of development these codes are modified or enlarged from time to time to keep abreast of recent progress.

Standardization of electrical characteristics such as voltage, number of phases, and frequency are virtually obligatory, because, with relatively few exceptions where apparatus has been specially designed, it is not possible to use equipment designed with one set of characteristics on a system operating under different characteristics. For the same reason it is likewise impossible to interconnect several systems of different electrical characteristics without the use of special coupling means.

³ Courtesy of Stone & Webster Engineering Corporation.

At the time of their initial adoption direct current and alternating current, single and two phase systems, were in turn the ultimate in the electrical transmission of energy. The decision was, of course, reached after a consideration of the economic and technical aspects of electrical science as it was then known, and the ability of manufacturers to produce apparatus having the proper characteristics. The elimination and retirement of these systems are now rapidly taking place except for certain special applications where their characteristics are peculiarly suited or where economic considerations are the governing factors. The present standard is to employ the 3-phase, 3-wire system for the transmission of energy in varying amounts from moderate to large quantities.

Twenty-five and sixty cycles, the latter being much more universal, are now regarded as standard frequencies. A notable exception exists in large systems, however, in the case of the Southern California Edison Co., which operates at 50 cycles. A multiplicity of distribution and transmission system voltages has been standardized to meet the conditions encountered in the various systems throughout the country, the highest being 220,000 volts. Systems employing this potential exist in California, New Jersey, Pennsylvania, and Maryland, and the most recent application has been made in New England in the States of New Hampshire and Massachusetts. Certain electrical and physical characteristics of a high potential transmission system are governed by the conditions of the particular problem under consideration and can be varied by the designing engineers, within certain limits, generally in accordance with standard practice. Natural conditions, however, such as ice, sleet, wind, temperature, lightning, and topography of the country, are unfortunately not subject to universal standardization, and extremely wide variations in these conditions occur in different parts of the country. General agreement is to be found, however, in certain details not directly affected by sectional variations in natural conditions, and other details more directly affected will be found in general agreement in particular areas.

In transmission systems where use is made of ferrous and non-ferrous metals, textiles, ceramic, and petroleum products, rubber, paper, and timber, the result of standardization has been not only to assist the engineer in specifying the proper material, but has enormously simplified the manufacturing and marketing procedure involved in the progress of raw materials from their natural state to the point of utilization. For instance, standards relating to conductors include specifications for quality, standardized tests, and uniformity in dimensions. In the case of insulators, there has been so much development in matters of design that standardization has been limited largely to methods of testing and to eliminating some of the older and less-used designs in the smaller sizes. Standardization of wood poles has not progressed so very well, largely due to the fact that poles are a product of nature and not of manufacturing processes. Dimensions have been standardized and a minimum quality has been established, but of those which are "passed," no definite standards have as yet been established for segregating them into various grades. Standardization of cross arms has had prin-

cipally to do with establishing uniformity of dimensions and drilling for distribution arms. A survey is now being made in the field which it is hoped will lead to the standardization of steel towers.

Standardization of physical characteristics, such as the size of apparatus used in the transport of electrical power in terms of its electrical units, physical dimensions and location of terminals is particularly desirable from the standpoint of low manufacturing costs and interchangeability of apparatus. Whereas physical dimensions of a particular piece of apparatus may vary somewhat between different manufacturers, electrical capacities and location of terminals have been standardized within the ranges most commonly found in practice. Considerable latitude is permitted the manufacturer in the selection of materials entering into the construction of apparatus, but through the agency of the various organizations previously referred to standards have been adopted by which to judge the electrical and physical limitations of the materials and thereby obtain a measure of their value in any particular instance.

STANDARDS FOR TRANSMISSION OF SPEECH

By WILLIAM H. HARRISON⁴

Since the earliest days of the telephone, the need for a unit in which to measure the transmission efficiency of telephone facilities has been recognized. The introduction of cable in 1896 afforded a stable basis for a convenient unit and the "mile of standard" cable came into general use shortly thereafter. This unit was employed up to 1923 when a new unit was adopted as being more suitable for modern telephone work. The new transmission unit is widely used among the foreign telephone organizations and recently it was termed the "decibel" at the suggestion of the International Advisory Committee on Long Distance Telephony.

The decibel may be defined by the statement that two amounts of power differ by 1 decibel when they are in the ratio of $10^{0.1}$ and any two amounts of power differ by N decibels when they are in the ratio of $10^{N(0.1)}$. The number of transmission units expressing the ratio of any two powers is therefore ten times the common logarithm of that ratio. This method of designating the gain or loss of power in telephone circuits permits direct addition or subtraction of the units expressing the efficiency of different parts of the circuit and is therefore especially advantageous in facilitating the design and maintenance of the telephone plant. The decibel is also of particular advantage in that, being based purely on power ratio, it has the same value for the same ratio at different frequencies. The "mile of standard" cable because of its distortion characteristics expressed a different ratio of power at different frequencies.

As a basis for expressing transmission efficiency, a standard reference circuit was adopted about 25 years ago, the circuit consisting of standard commercial transmitting and receiving equipment,

⁴ American Telephone & Telegraph Co.

cord circuits, and an artificial line variable in equivalent length. Improvements in the art during recent years have permitted the replacement of the older reference system with a new circuit which is substantially free from distortion. This new "master reference system," as it is called, consists of transmitting and receiving elements interconnected by a variable artificial line. The transmitting element of this reference system consists essentially of an air-damped condenser type transmitter with a stretched duralumin diaphragm and an associated vacuum tube amplifier. The receiving element is composed of an air-damped receiver of the moving coil type and an associated vacuum tube amplifier. The connecting line or attenuating element is composed of a distortionless resistance line with a variable range from 0 to 101 decibels in steps of 0.2 decibels. The transmitting and receiving elements both have electro-acoustic characteristics that are substantially distortionless and, as the impedances of the different elements are matched, the air-to-air reproduction ratio is practically distortionless.

The electrical and acoustic specifications of all parts of this master reference system are defined and measured in terms of definite physical quantities and every part of the system can, therefore, be exactly reproduced from the specifications. Each element is also provided with suitable adjustments for maintaining the standard of performance as determined by measuring and calibrating equipment associated with the system. The artificial line can, of course, be calibrated by common methods. For the basic calibration of the transmitting and receiving elements, however, a thermophone is employed. This instrument expresses a definite relation between electrical input and acoustic power and is itself capable of specification in definite physical constants.

In order to facilitate the measurements of commercial circuits which are not free from distortion, provision is made in the master reference system for the insertion of distortion networks.

This master reference system has also been recently adopted by the International Advisory Committee. By the adoption of the same reference system throughout the world and similar or comparable transmission units, a very great step has been taken toward the development of generally accepted world-wide standards of reference for all measurements relating to telephone transmission. In view of the rapidly expanding scope of intercontinental telephony at this time, it is particularly fortunate that these common standards have been adopted.

STANDARDIZATION OF OIL AND GAS PIPE LINES

By E. L. RAWLINS, *Natural Gas Engineer, United States Bureau of Mines*

Standardization of pipe lines for the transmission of oil and gas implies more economic installation and more efficient operation. Such standardization is now in an early state of development. Facilities for transmission of oil and gas in their relation to each other are dependent upon many complex factors; and standardization at this time is primarily a process of eliminating nonefficient and uneconomic practices rather than of recommending particular equipment and methods for construction and operation. Present

codes relating to oil and gas transmission refer more particularly to the pipe than to pipe-line construction methods; however, these codes are flexible and permit the recognition of development in the science of pipe manufacture.

Specifications have been prepared jointly by the Special American Petroleum Institute Committee on the Standardization of Specifications for Steel and Iron Pipe for Oil Country Tubular Goods and the Technical and Research Committee of the Natural Gas Department of the American Gas Association for line pipe which satisfy the requirements of both the petroleum and the natural-gas industries. These specifications apply to welded and seamless steel and welded iron tubular goods for pipe-line purposes, and include manufacture of pipe, chemical properties and tests, physical properties and tests, standard weights and lengths, workmanship and finish, inspection and rejection, and gages for screw pipe.

Research is an important factor in the development of pipe manufacture and pipe-line construction equipment. Some research projects contributing to this development are:

1. Welding research is contributing much to better standards for welded line construction, especially to the development of the technique for welding high-carbon steel.

2. The use of electric welding for pipe lines in recent years has aroused considerable interest, and its further application is being studied by manufacturers and individual pipe-line companies.

3. A study of the effect of high phosphorous steel for welded line pipe is now being conducted by the National Bureau of Standards for the American Society for Testing Materials and the American Petroleum Institute.

4. In both oil and gas transmission, thought is being directed toward definite specifications of pipe and other equipment for withstanding higher pressures than in the past.

5. Experimentation by individual companies, assisted by manufacturers, relating to the use of different kinds of joints has not only resulted in a better understanding of such usage, but has also resulted in the development of more efficient joints. The selection of a particular type of joint, or a combination of types, for a pipe-line installation depends upon the conditions of the installation and the preference of the designing engineers.

6. The American Petroleum Institute and the National Bureau of Standards are cooperating in an intensive research program on protective coatings to resist corrosion. This work is helping, first, to develop a code on the application of hot bituminous coatings, which is being followed to a large extent by many pipe-line companies, and second, to permit a more intelligent selection of sections of pipe line requiring protection.

The practices of individual companies in their construction work on the transmission of oil and gas show definitely the trend toward the elimination of uneconomic and nonefficient practices.

In the oil and gasoline industries, pipe-line construction methods are practically standardized; that is, all lines recently constructed have been solidly welded from one end to the other. On the other hand, the oil and gasoline pump stations are not so definitely standardized; they are subjected to personal preference as to types of pumps and methods of operation. An automatic oil-pump station,

which is a permanent exhibit at the International Petroleum Exposition in Tulsa, Okla., is an example of research which tends to evolve more efficient and reliable equipment.

It is debatable as to whether standardization has had any direct effect on the construction of long-distance transmission lines for petroleum products and natural gas. Long pipe lines for the transmission of oil were constructed and used before any definite standardization of the pipe was considered; and the construction of long-distance pipe lines for transmission of natural gas has been due mainly to the discovery of large natural-gas fields and the assurance that sufficient reserves of natural gas exist to warrant this construction.

The nature of standardization in construction for natural-gas transmission lines is somewhat different from that for the transmission of other petroleum products because of the many dissimilar problems which are peculiar to natural-gas transmission. Pipe lines, compressor stations, and other facilities are subjected to personal preference of the engineers who design them. Standardization is limited to the equipment which is used to build the pipe line rather than to any method of construction. Operating companies, however, maintain certain standards, but these standards vary so much among different companies that they can not be used as a collective unit. These standards include such items as types of weld and methods of making welds; drip construction and location, dependent upon particular needs; meter installations, which in general embody the standards advocated by the Technical and Research Committee of the Natural Gas Department of the American Gas Association; length of joints of pipe, the longer joints being considered an advancement for many installations; leakage determinations and elimination, and protection against corrosive action. All of these factors are, of course, subject to research, and more definite and useful standardization is possible only with continued research and the correlation of research already made.

At present it is not considered practical to attempt definite recommendations of standardization practices in the construction and operation of natural-gas transmission lines, and to some extent oil transmission lines, that would be applicable under all conditions; there are too many varying factors that have to be considered. Certain basic practices, however, can be and are being standardized, and the applicability of such basic principles is a distinct asset when used by competent engineers in designing pipe-line installations for the transmission of natural gas and other petroleum products.

STANDARDIZATION OF AUTOMOTIVE TRAFFIC RULES

By ERNEST N. SMITH, *Executive Vice President, American Automobile Association*

Adoption of an effective and harmonious system of traffic rules, as well as an orderly procedure for promoting safety, offers the only hope for the efficient and safe movement of the 35,000,000 motor vehicles that will be on the streets and highways by 1940. The greatest problem will be, as it has been in the past, within the limits of cities and towns where the principal streets were laid out prior to the advent of the automotive era.

In the past, as facilities for expediting traffic were provided and safety plans were perfected, they proved obsolete when considered from the standpoint of the year-to-year increase in the number of automobiles. As a result it became apparent that all efforts to set up standards for the desired smoothness in the flow of traffic, with safety to those at the wheel and pedestrians alike, must be considered in the light of future needs.

The so-called saturation point with regard to the number of motor vehicles in use, often predicted, is not yet in sight.

Scientific research, however, has made it possible to consider present-day traffic and anticipate the future volume on the basis of experience. Therefore, much progress has been made and much more will be made. But the progressive nature of the problem necessarily makes it a continuing one, requiring constant study and research.

The goal sought is a system which will facilitate understanding by the highway user of the requirements of any State or locality in which he may find himself. This objective, in terms of industry, is "standardization." In the field of traffic it is customary to use the term "uniformity."

The American Automobile Association, since its organization in 1902, has always been to the forefront in sponsoring uniformity and encouraging a coordinated program for all agencies interested in facilitating the use of the automobile with safety. It has sponsored uniformity in rules of the road, in the meaning of warning and direction signs, as well as traffic signals. It has sponsored uniformity in rules and regulations governing the operation of motor vehicles on the streets and highways. It has sponsored uniformity in the methods used to promote safety. Through its National Committee on Highway Widening and Planning, the A. A. A. has also sought to develop a uniform program for the use of political subdivisions and municipalities in "building safety into the highways" through the elimination of "bottle necks" and other points of congestion, as well as in planning arteries of travel to assure maximum use. Noteworthy progress has been made in all of these fields.

The achievements in securing uniformity in marking the highways have been particularly impressive. The car owner now finds standard warning and direction signs on virtually all of the interstate highways, and State agencies are rapidly placing them on secondary roads, but there are fields of even greater importance.

When the number of automobiles in use passed the 15,000,000 mark, six years ago, the American Automobile Association reaffirmed its belief that the multiplicity of diverse State and local laws governing car operation threatened to strangle motor transportation. The support of President Hoover, then Secretary of Commerce, was enlisted, and plans formulated for a National Conference on Street and Highway Safety.

Out of this and subsequent conferences there was developed the Uniform Vehicle Code and the Model Municipal Traffic Ordinance. The unqualified support of the more than 1,000 affiliated A. A. A. motor clubs was thrown behind this program of model legislation, and it has contributed in no small way to the revision of motor laws throughout the country. Without this effort traffic conditions to-day would be much worse.

Aside from lending its prestige and support to unified national efforts to improve conditions, the A. A. A. has met with signal success in its individual activities.

Through a national committee of 17, it promulgated the safety-responsibility law in 1928 and offered it as an effective weapon to curb the reckless driver. Although this suggested legislation, designed to encourage uniform laws affecting the drivers of automobiles, has been before the country less than three years, more than a third of the motor-vehicle owners in the United States and half of those in Canada are operating under one or more of the essential principles. Its appeal comes through the equitable idea of curbing the reckless without penalizing the great majority of careful drivers.

Uniformity has also been extended to the great humanitarian work of educating children to protect themselves and in assuring their safe passage across the lanes of traffic en route to and from the school room. This program includes the distribution of safety lessons and posters to more than 3,000,000 school children. It also includes the activity of 175,000 school-boy patrolmen in 500 cities, who daily guide 2,500,000 children through the maze of vehicular traffic. The result has been a steady decline in fatalities and accidents among children of school age.

But space does not admit a lengthy review of every phase of uniformity as it has been applied by organized motordom. So, in conclusion, let me turn to the phases of A. A. A. activity where the industrial term "standardization" may well be used. In this classification comes the standardized brake and headlight tests engaged in over the country to aid the motorist to keep his car mechanically safe. In it falls the standardization of 5,000,000 maps and tour publications issued annually. In it falls the national reciprocal service at the touring counter where the motorist in the far West receives the identical service offered in the more populous East, but it is sufficient to say that the standards sponsored by the national organization for its member clubs have improved the general conditions under which the owners and operators of 26,000,000 motor vehicles now enjoy the new freedom that the automobile has offered.

STANDARDIZATION OF AIR MAIL SERVICE

By E. B. WADSWORTH, *Superintendent of Air Mail Service, United States Post Office Department*

When the experiment of carrying mail by airplane was begun in the spring of 1918, between New York and Washington, the planes and pilots were provided by the War Department, and the ground force consisting of field managers, mechanics, and miscellaneous employees were provided by the Post Office Department. Such standardization of equipment as practicable at that time was worked out by the War Department.

Approximately six months after the service began the Post Office Department assumed the entire performance, relieving the War Department. The equipment obtained by the Post Office Department by purchase or transfer from other departments was so varied in character that standardization would have required more of an expenditure than was available in the appropriations for the entire service.

In addition, the planes available at that time were not of such stability of design or construction as to warrant standardization of any model until its performance had been observed over a considerable period. Owing to the access of the Post Office Department to excess equipment in the War Department of planes and equipment of the DH type with Liberty motors, attention was directed to their use in the service, and such improvements as were indicated thereby were standardized, such as landing and motor gears, mail compartment, cockpit equipment, etc., resulting in economy, speed in production, and the development of the air mail type of the DH plane, the performance of which is a matter of record and was, at that stage of development of aircraft, the subject of most favorable comment. Concurrent with the relinquishment of the Government-operated service to private interests under contract, the furnishing of flying equipment devolved upon the contractors. At the same time the lighted airway between New York and San Francisco, together with the emergency fields, were transferred to the Department of Commerce. During the development of this system the idea of standardization of landing fields and beacons was constantly a subject of study, which was directed toward efficiency combined with economy of maintenance.

Under the contract system standardization by the department is possible only in regard to contract forms and regulations governing the performance of the service.

II. INTERNATIONAL STANDARDIZATION AGENCIES

INTERNATIONAL COMMITTEE ON WEIGHTS AND MEASURES

ADVISORY COMMITTEE ON ELECTRICITY

The advisory committee on electricity is a subsidiary of the International Committee on Weights and Measures, authorized by the general conference of 1927. (Standards Yearbook, 1928, pp. 8-9.) Its membership is limited to 10. Eight members have been appointed, including one representative each from the national laboratories of Germany, Great Britain, Japan, Soviet Republics, and the United States, and one from the Laboratoire Central d'Electricité at Paris. The other two members appointed are the director of the International Bureau of Weights and Measures and Prof. L. Lombardi, of the Royal School of Engineers at Rome.

The advisory committee met first in 1928, when it adopted resolutions looking definitely toward the establishment of electrical units based directly upon the centimeter-gram-second system instead of upon arbitrary standards, such as the mercury ohm tube and silver voltmeter, which are the basis of the present international units. (See Yearbook, 1929, pp. 179-181; Yearbook, 1930, pp. 11-13, 144-146.)

In 1929 the International Committee on Weights and Measures approved these proposals of the advisory committee and asked for continued assistance on electrical units and standards. It also decided to take up the problem of obtaining international agreement on measurements of light, and instructed the same advisory committee to consider methods, units, and standards for such measurements. Consequently, the 1930 meeting of the advisory committee, held in Paris, June 23, 24, and 25, was devoted largely to this new problem.

A considerable part of the proceedings centered around documents submitted by the Director of the Bureau of Standards. On account of their importance and general interest, two of these are printed elsewhere in this volume. (See Photometric Units and Methods, p. 37, and Proposals Concerning the Primary Standard of Light, p. 42.) In these documents it was proposed that a "black-body" radiator at the freezing point of pure platinum be adopted as the primary standard of light. This type of standard was originally proposed by Waidner and Burgess in 1908, but has only recently reached the stage of actual realization in a satisfactory form. Work on it which has been carried out in the laboratories of the bureau during the past year has given results of high precision, as reported in the second document mentioned above.

The conclusions reached by the advisory committee with regard to standards of light were expressed in the following resolutions (translated from the official French text):

A. Primary standard of light:

1. The advisory committee on electricity supports the opinion of the International Commission on Illumination that a black-body radiator operated under specified conditions should be adopted, at the present stage of technical development, as the primary standard of light.

2. The advisory committee requests the several national laboratories to examine the specifications for the construction and operation of the black-body standard submitted by the Bureau of Standards and to give their opinions regarding the practicability of adopting the standard thus specified.

3. The advisory committee recommends that additional determinations of the brightness of the black-body radiator be made, especially under the conditions prescribed in the proposed specifications or at least under conditions comparable with those prescribed.

B. Units of light:

1. The advisory committee believes that it would not be expedient to change the unit which has been in common use in several countries since 1909 and which has been adopted by the International Commission on Illumination.

2. The advisory committee expresses the hope that all countries may accept this unit as soon as pending questions of measurement are settled.

C. Maintenance of units:

1. The advisory committee proposes that the national laboratories immediately exchange and compare groups of carbon-filament lamps, or of others operated at a corresponding color, and submit for the International Committee on Weights and Measures precise information regarding the relative values of the units of candlepower as now maintained in the several laboratories.

2. Assuming that any differences disclosed by such comparisons will be removed by agreement among the national laboratories, the advisory committee proposes to make periodic comparisons in the future under the auspices of the international committee.

3. Recognizing the importance of uniformity and continuity in the values of the practical secondary standards, the advisory committee recommends that any future adjustments of these values which may become necessary as a result of reference to the primary standard shall be made by international agreement approved by the International Committee on Weights and Measures.

D. Secondary standards for diverse colors of light.

1. The advisory committee recognizes the importance of the cooperative studies now being made by the national laboratories on the measurement of transmission of colored filters, and expresses the hope that these studies will lead to agreement on a standard method for making such measurements as well as to accepted values for the particular filters.

2. The advisory committee will be pleased to receive for its own information, and for transmission to the International Committee on Weights and Measures, any reports on the progress of these studies which can properly be published.

With regard to electrical units and standards, the following conclusions were reached:

1. With regard to the unit of resistance, the ohm, considering that methods of determining the absolute ohm are sufficiently advanced and that the agreement between the measurements of the coils (secondary standards) of the different laboratories remains within the limits of precision of the measurements, it is not necessary at present to undertake further comparisons of the resistance coils with mercury ohms.

2. As to the units of electromotive force, on the contrary, the international comparisons of standard cells show differences exceeding the limits of possible precision between the values of the electromotive force of the standards of different countries. The committee considers that it is absolutely necessary to make new determinations of the electromotive force of the international Weston cells in each national laboratory by means of the silver voltameter.

The conditions under which the silver voltameter should be used are specified sufficiently in the report of the international committee which met in Washington in 1910. The advisory committee recommends, however, that the national laboratories use the Smith or the Kohlrausch voltameter, avoiding all organic material since it has a bad effect on the electrolytic deposit.

The groups of Weston cells prepared in the several laboratories can be considered as sufficiently constant until the absolute unit of current shall be established.

The advisory committee also made recommendations regarding the equipment of the International Bureau of Weights and Measures and plans for cooperation between that bureau and the national laboratories in work on electric and photometric standards. Since another general conference on weights and measures is due to be held in 1933, the advisory committee felt that it should meet again before that time to study the comparisons of standards which shall have been made and to assign values in absolute units for the standards of resistance and of electromotive force.

PHOTOMETRIC UNITS AND METHODS

A Memorandum Submitted to the Advisory Committee on Electricity of the International Committee on Weights and Measures by George K. Burgess, Director, Bureau of Standards, Washington, D. C., United States of America

At its 1929 meeting the International Committee on Weights and Measures adopted the following resolutions (*Proces Verbaux*, p. 67) :

1. The International Committee on Weights and Measures, considering the importance of unifying the methods used in photometry, decides to study the question of the adoption of an international system of units of light.

2. For this purpose the international committee charges the advisory committee on electricity to advise it on all questions relating to the methods of measurement and to the units and standards of light.

3. The International Committee on Weights and Measures authorizes the advisory committee to solicit for the study of these questions the collaboration of the national laboratories and of the International Commission on Illumination.

This resolution indicates the desire of the international committee to assist in obtaining world-wide agreement on photometric units and standards, while recognizing the progress already attained through other agencies.

There are several reasons which make it desirable that the international committee assume jurisdiction over photometric units and standards. This action would centralize in a single organization the responsibility for photometric and electric standards, as well as those of length, mass, and temperature. It would simplify the handling of international comparisons of standards and avoid duplication of organizations for similar purposes. In fact, the creation of another organization having the legal status of the bodies which now deal with weights and measures would be quite impracticable. If we are to have any formal and legal establishment of international units, it must be accomplished through the international committee, acting under the authority of the general conference.

On the other hand, standards of light are very different from the standards of length and of mass hitherto recognized. Light is essentially a transient phenomenon. The "standards" used are really equipment for producing a desired effect. In this respect they are somewhat similar to the standards which represent the electrical units.

For this reason an international agency would not be expected to establish a single basic standard to which those of the several coun-

tries must conform. It should rather serve to coordinate the results of experimental work done in all laboratories and to make those results available to all countries.

Fortunately the principles and general procedure suggested above have already been recognized as applying to international electrical units and standards. The way seems clear, therefore, for the consideration of photometric questions on the assumption that they will be dealt with in a similar manner.

Present Status of Candlepower Standards.—At present there is no reproducible primary standard generally accepted as a basis for measurements of light. The units used in several countries were originally derived from various primary standards, but in actual practice those units are usually based upon groups of carbon-filament electric lamps for which candlepower values (at specified voltages) were adopted many years ago. Such groups of electric lamps have been found to show changes over long periods much smaller than the uncertainties which would be introduced by deriving new values from the primary standards.

Nevertheless it is granted that the electric lamps change with use, and that some accurately reproducible primary standard should be devised and accepted as a basis for our system of units. The establishment of such a primary standard is logically the first step to be taken, but it need not necessarily be taken first in order of time. Two other problems need to be considered concurrently with it; in fact, for practical purposes they are even more pressing.

These two problems are, first, the existence of two distinct units, and, second, the further divergences which have arisen in extending measurements from the basic carbon-filament lamps to more modern types operating with the filaments at higher temperatures. These divergences increase as operating temperatures and efficiencies are increased, and have attained a magnitude of at least 5 per cent for some lamps in common use.

The Primary Standard of Light.—As a result of many years of study and experiment, it is accepted that the most promising possibilities for a primary standard that would be both theoretically satisfactory and practically attainable are found in the "black body" or complete radiator. The International Commission on Illumination at Geneva in 1924 adopted the following resolutions:

The International Commission on Illumination recommends the international adoption, as the primary standard of light, of the brightness of a black body operated under conditions which are subject to accurate specification.

This commission recommends to the national laboratories that they take steps—

1. To formulate standard specifications for the construction and the conditions of operation of the black body as a primary standard of light.
2. To establish a definite value for the brightness of the black body operated under these conditions, expressed in international candles per square centimeter.

These resolutions left for future study the determination of conditions of operations of the black-body furnace. There are, however, strong reasons for adopting the freezing point of platinum as the basic fixed point in a scale of brightness. This is a temperature readily obtainable by present technique in furnace operation; plat-

inum can be prepared with a high degree of purity; the use of its freezing point as the specified temperature makes the standard independent of any numerical scale of temperatures and also avoids the interpolation or transfer of values by any temperature-measuring device; finally, the color of the light is practically identical with that given by the present carbon-filament standards, so that a very accurate comparison with those dependable practical standards can be made.

Values of brightness of the black-body furnace at points of higher temperature might later be established; for example, the melting point of rhodium might be taken, since it would give a color nearer to that of the lamps most commonly used. In fact, a complete scale of brightness correlated with the temperature scale might be adopted. In either case, however, the platinum point would be desirable as a primary point of reference.

There are now available two very precise determinations of the brightness of the black body at the platinum point, and these agree as closely as the relative values of the carbon-filament standards are known. Brodhun and Hoffman¹ at the Physikalisch-Technische Reichsanstalt found a brightness of 65.24 Hefner candles per square centimeter. The Hefner unit is supposed to be 0.9 of the "international" unit, so that this result corresponds to 58.72 international candles per square centimeter. At the Bureau of Standards, Wensel, Roeser, Barbrow, and Caldwell² have obtained the preliminary value, 58.88 candles per square centimeter, using the radiation from a black body immersed in molten platinum.

It is believed that the conditions used in this latter work are more favorable for exact reproduction in other laboratories, and, hence, more suitable for adoption as defining the primary standard. The numerical value given is subject to some correction, depending on the transmission of the optical apparatus used in connection with the black body. Final results will be reported later to the advisory committee, and definite proposals for specifying the standard will be submitted. It is hoped that other laboratories will make experimental tests of the procedure in the near future.

It is understood that experimental work on this subject is in progress in France,³ Germany,⁴ Great Britain, and Japan so that other numerical results comparable with those mentioned above may soon be available for the committee.

The Unit of Light.—Light as a visual effect involves physiological and psychological reactions. These reactions depend so largely on the conditions of observation that there seems to be no real advantage in choosing a unit of light having a specified relation to the unit of mechanical or electrical power.

If the black-body furnace is adopted as a primary standard some simple fraction of its brightness (intensity per square centimeter)

¹ *Zeitschrift für Physik*, 37, p. 137; 1926.

² Progress report presented before Optical Society of America, Oct. 24, 1929. Further experiments are in progress and final results will be published in the Bureau of Standards Journal of Research.

³ See report on work of P. Fleury, J. Choppius, and others, *Proc. Int. Com. on Illum.*, pp. 1102-1115, 1928.

⁴ C. Mueller, *Proc. Int. Com. on Illum.*, pp. 1116-1137, 1928.

might be taken as a unit, but this simplification would be useful only in defining the unit while the change of units would cause much trouble and annoyance.

Our present units of light have arbitrary values. Their magnitudes arose from the natural limitations on the size and brilliance of open flames. Nevertheless the only good reason for considering a change in them is the fact that we have two.

Unfortunately the difference between the two units is so large that the adoption of a compromise value would have all the disadvantages of a change for every one, and would give us for a time the added confusion of three units instead of two. Consequently, the question resolves itself into this: Are the advantages of international uniformity important enough to justify asking the countries which use the Hefner unit to change their practice?

If such a change in units is ever to be made, it could most naturally be done when a new primary standard is adopted. Whether a change of the kind suggested is practicable is a question which the international committee can not decide. The best course it can take is to promote the establishment of standards in which the simple ratio of 9 to 10 between the two units shall be accurately maintained, and to hope that all countries will eventually find it expedient to use the larger unit.

Maintenance of Fundamental Units.—It is hoped that a primary standard can be adopted which will be so simple and convenient that frequent confirmation of the fundamental units will be practicable. The incandescent-filament lamps will nevertheless continue to be the actual working tools of the photometric laboratory. They will serve to maintain the units in the intervals between redeterminations by the primary standard. They also afford the only practical means of transferring values from one laboratory to another, and thus of comparing the results of different primary determinations.

It is desirable, therefore, that a complete and precise comparison of fundamental incandescent-lamp standards be made among the laboratories concerned, in preparation for the assignment of a specified numerical value for the primary standard. An interchange of carbon-filament lamps for this purpose has already been initiated between the national laboratories. If discrepancies are disclosed by this comparison they can be adjusted in fixing the primary values.

Periodic intercomparisons should be made at suitable intervals among the national laboratories by means of incandescent-filament lamps, for the purpose of maintaining uniformity; changes in the values assigned for working standards made necessary by new primary determinations should be made only by international agreement ratified by the International Committee on Weights and Measures.

Standards at Higher Temperatures.—When satisfactory standards are established for light like that from the carbon filament, the measurement of practical commercial lamps still presents difficulties because of differences in color of the light. For these difficulties no solution can be given by purely physical methods. At some stage the physiological and psychological processes of vision

must come in, and these give different results under different conditions.

Various devices have been used to remove the difference of color in such measurements. For example, filters of colored glass or liquid may be chosen which make the transmitted light from one lamp similar to that emitted from another. In assigning values of transmission for such filters, however, one must make measurements on the lights of different color. Agreement on transmission factors for particular filters is therefore a mere expedient; the fundamental question is the method to be used in measuring the transmissions. Similarly, the establishment of different sets of standard lamps for light of different colors or the acceptance of equations representing the variation of intensity of light with the voltage or current supplied to the lamp, must depend on having some method of measuring the light satisfactorily over a considerable range of color.

In addition to setting up satisfactory fundamental standards, it is therefore necessary to establish also a standard method capable of giving reliable values for other lamps differing from the fundamental standards in color of light. This problem has been the subject of discussion between the national laboratories for several years, and an experimental project including measurements on colored filters in four laboratories has been in progress for the last two years. In view of this activity, the advisory committee may well call on these laboratories for special advice on this phase of the general problem. In the expectation that the advisory committee will wish to refer this question to the national laboratories, no discussion of the merits of different methods of measurement will be attempted in this memorandum.

If the cooperative measurements now in progress open the way to an agreement among the laboratories, satisfactory to them and to the International Commission on Illumination, the International Committee on Weights and Measures might be advised to add its formal approval so as to give still wider recognition to the accepted method of measurement. Considering the urgent industrial demands for settlement of this question, the advisory committee should stress the desirability of action by the national laboratories and the International Commission on Illumination at the 1931 session of the commission.

Suggested Resolutions.—In order to summarize this discussion in a form suitable for definite action by the advisory committee, the following resolutions are proposed:

(a) Primary standard:

1. The advisory committee on electricity supports the view of the International Commission on Illumination that a black-body radiator operated under specified conditions should be adopted as the primary standard of light.

2. The advisory committee recommends that the freezing point of pure platinum be adopted as the basic reference temperature of the black-body standard.

3. The advisory committee requests the several national laboratories to examine the specifications for the construction and operation of the black-body standard submitted by the Bureau of Standards, and to give their opinions regarding the practicability of adopting the standard thus specified.

4. The advisory committee urges the desirability of additional determinations of the brightness of the black-body radiator, especially under the conditions

prescribed in the proposed specifications or at least under conditions comparable with those prescribed.

(b) *Units of light:*

1. The advisory committee believes that it would not be expedient to change the unit which has been in common use in several countries since 1909, and which has been adopted by the International Commission on Illumination.

2. The advisory committee expresses the hope that all countries may eventually find it possible to accept this unit so as to bring about complete uniformity of units.

(c) *Maintenance of units:*

1. The advisory committee suggests that the national laboratories immediately exchange and compare groups of carbon-filament lamps, or of others operated at a corresponding color, and submit for the International Committee on Weights and Measures precise information regarding the relative values of the units of candlepower as now maintained in the several laboratories.

2. Assuming that any differences disclosed by such comparisons will be removed by agreement among the national laboratories, the advisory committee suggests the desirability of periodic comparisons in the future under the auspices of the international committee.

3. Recognizing the importance of uniformity and continuity in the values of the practical secondary standards, the advisory committee recommends that any future adjustments of these values which may become necessary as a result of reference to the primary standard shall be made by international agreement approved by the International Committee on Weights and Measures.

(d) *Standards for diverse colors of light:*

1. The advisory committee recognizes the importance of the cooperative studies now being made by the national laboratories on the measurement of transmission of colored filters, and expresses the hope that these studies will lead to agreement on a standard method for making such measurements as well as to accepted values for the particular filters.

2. The advisory committee will be pleased to receive for its own information, and for transmission to the International Committee on Weights and Measures, any reports on the progress of these studies which can properly be released.

3. The advisory committee hopes also that an agreement on methods for measuring lights of diverse colors may be formulated in time for consideration by the International Commission on Illumination at its 1931 session.

(e) *Functions of the International Committee and the International Bureau:*

1. The advisory committee believes it to be appropriate and desirable that the International Committee on Weights and Measures take jurisdiction over international work on photometric units and standards in order to avoid duplication of organization and division of responsibility.

2. The advisory committee recommends, however, that the international committee continue to seek the advice and cooperation of the International Commission on Illumination, since that commission represents those most concerned with measurements of light.

3. The advisory committee expects that eventually the International Bureau of Weights and Measures will fulfill the same functions for the photometric standards as are assigned to it for electrical standards, but, in view of the limited staff and lack of facilities, its operations for some time must be confined to secretarial work in connection with the exchange and comparison of standards.

PROPOSALS REGARDING THE PRIMARY STANDARD OF LIGHT

Submitted to the Advisory Committee on Electricity of the International Committee on Weights and Measures by George K. Burgess, Director, Bureau of Standards, Washington, D. C., United States of America

The general memorandum on Photometric Units and Methods submitted to the advisory committee under date of March 4, 1930, set forth the advantages of using an integral radiator (black body) at the freezing point of platinum as the primary standard of light. The proposal made by Waidner and Burgess⁵ in 1908 has very re-

⁵ Electrical World, 52, p. 625; 1908.

cently been developed into an experimental procedure suitable for precise reproduction. This work has been done at the Bureau of Standards by Wensel, Roeser, Barbrow, and Caldwell, and a detailed report will be published in the bureau's Journal of Research.

Essential details of the apparatus are described in the specifications for a primary standard which are forwarded herewith for the consideration of the advisory committee. As was indicated in the general memorandum, the results obtained with this apparatus agree with those of Brodhun and Hoffmann⁶ at the Reichsanstalt as closely as one knows the relative values of the candlepower standards used as bases for the two results. However, as compared with the method of Brodhun and Hoffmann, which requires the production of a space at uniform temperature in a resistance-wound furnace the method now proposed seems to offer better promise of reproducibility in different laboratories.

The preliminary value given for the brightness of the standard (58.88 candles per square centimeter) was subject to correction resulting from more accurate determination of the transmission of the optical parts used to project the light from the radiator upon the photometric surface. The final value is 58.84 candles per square centimeter. This can be expressed also by saying that an intensity of 1 candle is given by an area of 1.700 square millimeters. These values are based upon a group of 6 carbon-filament lamps constituting part of the 45 lamps used by the Bureau of Standards to maintain the unit of candlepower adopted in 1909.

The ratio of the electrical resistance at 100° C. to that at 0° C. of the platinum ingot No. 1 was 1.3918 before and 1.3903 after the 150 melts and freezes made during this and other work.

The precision and consistency of the results can be judged from the following tabulations of data. The parts of the apparatus mentioned are shown in the description including Figure 3 at the end of the proposed specification.

1. Data on transmission of lens and prism

| Observer | Box method | Pyrometer method | Mean |
|-----------|--------------------|---------------------|-----------------|
| | <i>Per cent</i> | <i>Per cent</i> | <i>Per cent</i> |
| A..... | ^a 76.93 | ^c 77.03 | 76.98 |
| B..... | ^a 76.93 | ^c 76.93 | 76.93 |
| C..... | ^a 76.89 | ^c 76.85 | 76.87 |
| D..... | ^b 76.97 | ----- | 76.97 |
| Mean..... | 76.92 | 76.94 | ----- |

^a Average of 12 sets.

^b Average of 6 sets.

^c Average 4 freezes.

Value used 76.93 per cent.

⁶ Zeitsch. f. Physik, 37, p. 137; 1926.

2. Data on black-body brightness

PLATINUM INGOT No. 1

| Observer | | | |
|---|--------------------------|--------------------------|--------------------------|
| A | B | C | D |
| <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> |
| 58.69 | 58.48 | 58.92 | 58.46 |
| 58.87 | 58.54 | 58.56 | 59.10 |
| 59.15 | 58.78 | 59.23 | 58.67 |
| 59.09 | 58.82 | 59.15 | 59.07 |
| Mean...58.95 | 58.66 | 58.96 | 58.83 |
| Mean of ingot No. 1 = 58.85 c/cm ² . | | | |

PLATINUM INGOT No. 2

| Observer | | | |
|---|--------------------------|--------------------------|--------------------------|
| A | B | C | D |
| <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> |
| 58.61 | 58.81 | 59.13 | 58.53 |
| 58.88 | 58.86 | 58.97 | 58.95 |
| 58.65 | 58.59 | 58.46 | 58.73 |
| 59.14 | 59.01 | 59.09 | 59.02 |
| Mean...58.82 | 58.82 | 58.91 | 58.81 |
| Mean of ingot No. 2 = 58.84 c/cm ² . | | | |

| Ingot | Observer | | | |
|------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | A | B | C | D |
| | <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> | <i>Cp/cm²</i> |
| No. 1----- | 58.95 | 58.66 | 58.96 | 58.83 |
| No. 2----- | 58.82 | 58.82 | 58.91 | 58.81 |
| Mean----- | 58.88 | 58.74 | 58.93 | 58.82 |

Grand mean = 58.84.

3. Summary of data

| | | |
|---|----------------------------|--------|
| Focal length of lens----- | cm-- | 25 |
| Diameter of opening in diaphragm----- | cm-- | 1.9082 |
| Distance diaphragm to test plate about----- | cm-- | 340 |
| Distance standard lamp to test plate about----- | cm-- | 125 |
| Distance comparison lamp to transmitting test plate about----- | cm-- | 125 |
| Candlepower of group of 6 carbon primary standard lamps, average----- | | 17.723 |
| Transmission of lens and prism----- | per cent-- | 76.93 |
| Brightness of black body immersed in freezing platinum-- | candles/cm ² -- | 58.84 |

Discussion of Sources of Errors.—The diameter of the diaphragm was measured both on a dividing engine and with standard gages, the error in the area being too small to affect the result by more than 3 or 4 parts in 10,000. The distances from the test plate to the standard lamp and to the diaphragm were measured to an accuracy of 0.1 mm by means of a long steel bar graduated and checked by the length measurements section of the bureau. The error from this source, since the errors made are accidental and will largely balance

out, is not sufficient to affect the result by more than 2 parts in 10,000. The rated candlepower for the six standard lamps, average for the group, is taken as exact, the result being expressed as *relative to this group of lamps*.

The value obtained for the transmission of the lens and prism is considered good to 5 parts in 10,000.

The experimental error in matching the photometer is considered to be 1 part in 1,000.

Summary of possible errors

| | Per cent |
|-------------------------------------|------------|
| Area of diaphragm----- | ± 0.03 |
| Distance measurements----- | $\pm .02$ |
| Transmission of lens and prism----- | $\pm .05$ |
| Lack of black body conditions----- | $-.1$ |
| Photometric matching----- | $\pm .1$ |

It is believed that the result is not high by more than 0.1 per cent or low by more than 0.2 per cent.

SPECIFICATIONS FOR THE PRIMARY STANDARD OF LIGHT

I. General.—1. The primary standard of light shall be an integral radiator (black-body radiator, Hohlraum).

2. The radiator shall be operated in pure platinum at its freezing point.

3. The present unit of light, "the international candle," is represented by such a radiator having a projected area, normal to the line of sight, of 1.700 square millimeters.

II. Construction of the Standard Radiator.—1. The method of heating shall be by electromagnetic induction, the heat being generated directly in the platinum.

2. The crucible containing the platinum, the crucible cover, and the sight tube immersed in the platinum shall be made of a material which will not contaminate the platinum. (See Sec. III.)

A recommended material is fused thorium oxide ground to such a fineness that all will pass through a sieve having openings approximately 0.15 mm square. A suitable binder for the oxide is a solution of 1 gram of thorium chloride in 5 ml of water. The thorium oxide can best be ground in a steel ball mill, the iron thus introduced being subsequently removed by an acid treatment.

3. The crucible shall be disposed practically as illustrated in Figure 2 herewith, and the dimensions shall be as follows:

| | |
|---|---------------------|
| Inside diameter of crucible at top----- | 22 mm \pm 2 mm |
| Inside diameter of crucible at bottom----- | 17 mm \pm 2 mm |
| Inside height of crucible----- | 45 mm \pm 5 mm |
| Inside diameter of sight tube----- | 2.5 mm \pm 0.2 mm |
| Thickness of wall of sight tube, between----- | 0.25 mm and 0.50 mm |

The opening in the cover of the crucible shall be at least 0.8 mm in diameter less than the inside diameter of the sight tube. The opening in the crucible cover, the sight tube, and the crucible shall be coaxial. The sight tube shall be filled to a depth of 10 to 15 mm with the material from which the crucible and sight tube are made.

The crucible shall be thermally insulated by packing around it more of the material from which it is made.

Packing with the fused and ground thorium oxide adjacent to the crucible as indicated in Figure 2 is advantageous because it avoids shrinkage of the material and prevents the platinum from leaking out through the cracks which usually occur in the crucible.

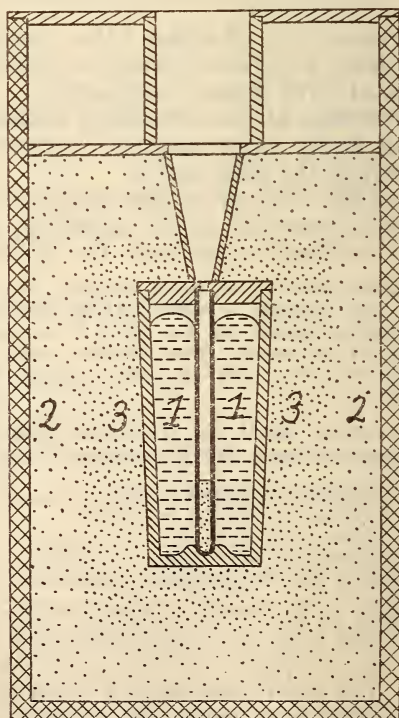
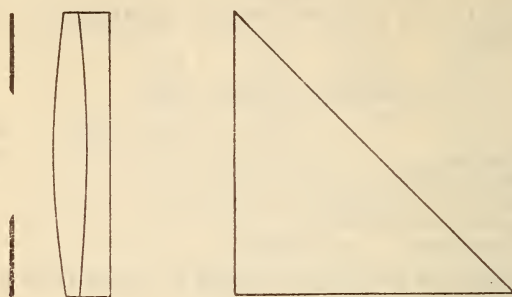


FIGURE 2

III. Purity of the Platinum.—1. The criterion for purity of the platinum shall be the temperature coefficient of electrical resistance.

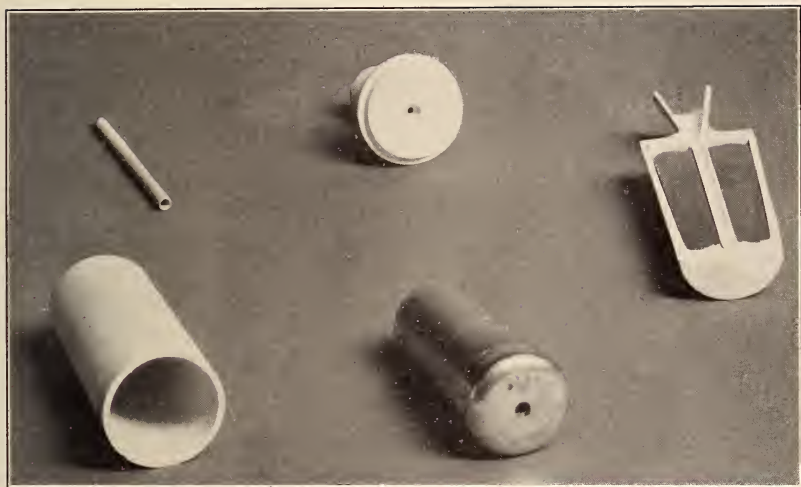


FIGURE 4.—*Platinum ingot and parts of crucible used in the black-body standard of light*

2. The platinum used shall be of such purity that the ratio of its electrical resistance at 100°C. to its electrical resistance at 0°C. shall not be less than 1.390.

3. Tests shall be made to determine that the material used for the crucible does not contaminate the platinum sufficiently to reduce the coefficient below the specified value.

IV. Method of Operation.—1. Only the observations taken during the transition of the platinum from the liquid to the solid state shall be used.

2. During the period preceding freezing, energy shall be supplied to the induction furnace so as to secure uniformity of temperature in the metal by the stirring effect thus produced.

3. During freezing the power supply shall be controlled so as to give a constant intensity over a period of at least three minutes.

V. Photometric Methods.—The apparatus and methods to be used in comparing the luminous intensity of the primary standard with that of secondary standards are not prescribed. It is obvious, however, that accurate measurement of the actual area of the aperture of the radiator is impracticable. Consequently a method should be used which depends upon the brightness (intensity per unit area), rather than upon the total luminous intensity of the radiator.

METHOD USED BY THE BUREAU OF STANDARDS

The following procedure has been used at the Bureau of Standards and is recommended:

A diagrammatic sketch of the apparatus is shown in Figure 3, and the parts in Figure 4. The test plate *H* of magnesium carbonate is illuminated first by light from the standard lamp at *I* and next by light from the black body immersed in freezing platinum at *J*. The lens *L* forms an image of the black body opening on the test plate *H*. The diaphragm at *K* serves to define the solid angle used.

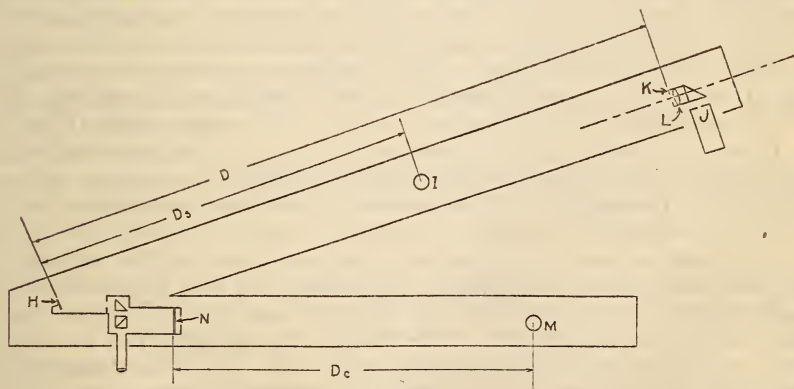


FIGURE 3

The ratio *R* of the illumination falling on the test plate in the two cases above is determined from D_c' and D_c'' the respective distances of the comparison lamp *M* from the test-plate *N* at which a photometric match is obtained between this test plate and the test plate *H* in these two cases.

The color temperature of the comparison lamp was adjusted to be approximately midway between that of the standard lamp and that of the black body during the freezing of the platinum.

The brightness (candlepower per cm^2), B , of the black body and the candlepower S of the standard lamp are related by the formula

$$B = \frac{S}{AT} \left(\frac{D}{D_s} \right)^2 \left(\frac{D_c'}{D_c''} \right)^2$$

where T is the transmission of the lens and prism and A is the area of the diaphragm opening in cm^2 .

The light transmission of the lens and prism used at the bureau was determined by two methods. In the first method, a light box was used and the transmission determined from the two distances of the comparison lamp from the translucent test plate at N when this test plate was matched first with the box directly, and next with the box when the lens and prism were interposed. In this work, the color temperature of the light from the box and that of the comparison lamp were made equal to that of the black body.

In the second method an optical pyrometer, with red screen removed, was first sighted through the lens and prism into the black body, J , during freezing of the platinum. The optical pyrometer was then sighted into the black body during a freeze, the lens and prism being replaced by a sector disk of approximately the same light transmission (as determined by the box method). The other sector disks were also used, one of slightly greater and one of slightly less transmission than the first. The variation of the pyrometer lamp current with transmission was thus determined and used to determine the difference in transmission between the lens-prism combination and the sector of nearest value. As it happened this difference was only 1 part in 10,000 in current or 1 part in 2,000 in transmission.

The average results obtained with the two methods are practically identical, but the pyrometer method seems to have decided advantages.

INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES

(Paris, France)

(From a Memorandum Received from the Director)

The International Bureau of Weights and Measures has been busily engaged, during the past year, with the addition of a section dealing with electrical standards. For this, the advisory committee on electricity, which had met once at the Pavillon de Breteuil, held a second session in June of this year. This session was held in order to take up at once the general program of the consulting committee from which would issue the program of work of the international bureau.

It was decided to add the photometric units to the electrical units, and to give the committee the title of advisory committee on electricity and photometry. Furthermore, the recently published report of this committee contained numerous documents relative to the comparisons already made between the standards of the volt and of the ohm of various countries. Mr. Jimbo, of the Electrotechnical Laboratory of the Ministry of Communications of Tokyo, visited the various laboratories in 1928 and 1929 and gathered important data on the values for the present standards. Mr. Chatelain and his principal collaborators have published a series of notes on the standards. Other notes are from the Director of the Bureau of Standards in Washington, from the Executive Committee of the National Physical Laboratory, from the President of the Physikalisch-Technische Reichsanstalt, from the Director of the Laboratoire Central d'Electricité, etc. The ensemble of these reports forms a series of very complete data, which will constitute a guide for the work of the

international bureau. This latter has wished to commence the comparisons without further delay, but the laboratories have not yet been completed, although they will be soon. It is well known that these new laboratories have been built, thanks to the donation of John D. Rockefeller. The bureau has been, and is still, engaged on the expansion of the metric prototypes. It is now agreed that the experiments of Messrs. Guillaume, Maudet, and Volet show that the expansion of all the standards of the same melt is identical, within the extreme limits of error of the observations. Therefore, to determine the expansion of the International Prototype Meter, which is inaccessible, it is possible to use other standards of the same melt. Use has been made of prototypes Nos. 20 and 26, T_2 and T_3 , employed at the bureau for various determinations. This time A. Perard was added to the preceding observers. The most probable figures now appear to be given by the formula:

$$L_t = L_0 [1 + (8.620 + 0.00180) 10^{-6}]$$

These figures are still subject to revision.

The quartz standards for which everything was prepared in 1927 have been delayed in construction, because too high a price for these standards was set. Samuel S. Stratton, former Director of the Bureau of Standards and member of the International Committee of Weights and Measures desired to come to the aid of the bureau by giving to the bureau a beautiful piece of quartz, with which all the standards might be made, if, finally this quartz proved to have a satisfactory homogeneity.

Effort has been made, meanwhile, to establish a definite price for the quartz of the requisite dimensions. But a new difficulty has arisen: the Bureau of Standards has made standards of fused quartz, a substance which, exposed to a very high temperature for its fusion no longer undergoes, it seems, modifications in the course of time, so that the Bureau of Standards has some doubt concerning the need for length standards of crystal quartz. A study of this subject, on these materials, will be undertaken by the international bureau as soon as a decimeter of fused quartz will have been sent through the effort of the Bureau of Standards.

It is evident that the question is receiving due attention and will soon be settled.

The international bureau had conceived the idea of a verification of its mural base of 24 m, by the determinations of 24 m wires measured on this base and sent to various laboratories where they would be measured.

This was begun by sending them first to the National Physical Laboratory. Four wires carefully studied were rolled on a drum, and sent to Teddington. There they were determined on the base, and were found to differ by 0.05 mm from the value of 24 m at Teddington. They were then sent to Charlottenburg, where they remained more than a year, so that because of the variation possible in the length of the wire in the course of time, one can not draw any certain conclusions from the comparisons which have been made.

It seems, however, that the problem should be divided, and the wires measured not upon the secondary base of the bureau, but

directly by means of microscopic markings on the primary base. The bureau has then to establish wires whose small graduated scales are arranged to be observed by the microscope, so that the comparison will be made directly by these new wires. Their construction has been nearly completed, and the work of comparison will commence immediately thereafter.

Thermometry is completely reestablished at the bureau. It should be remembered that the difficulty of obtaining hard glass of constant quality has compelled the bureau to renounce the use of this material. Moreover the death of Baudin, who was for a very long time the only furnisher of precision thermometers, made it impossible to obtain thermometers of the first order. The thermometers received from various countries have not given satisfaction. The Corporation of Chemical Factories of Rhone-Poulenc, now accustomed to the needs of the international bureau, furnishes very excellent thermometers. For the bulb, which forms the essential part of the thermometer, Jena glass 16^{III} has been secured; this is used with French glass for the stem, and thermometers, comparable with the old ones, are now being made. The bureau has, at this moment, under study, thermometers which ought to occupy it for many months.

Besides this work, the bureau has constantly to make determinations for State institutions or for individuals who address it in order to obtain suitable standards. The new countries, such as Poland and Czechoslovakia, as organized at the time of the war, had been forming their bureaus of weights and measures and, above all, central bureaus. The international bureau has provided for the determinations of the principal standards for these bureaus.

The geodetic wires have brought much work; the U. S. S. R. alone has called for 65 at one time. These must undergo all the processes which precede their determination properly so-called, and for this, 100 individual measurements on the base had to be made.

These determinations, with numerous measures of expansion have not permitted the undertaking of individual work during the year.

However, Volume XVIII of the *Travaux et Mémoires* was completed in March, and has been distributed to the contributory nations. This volume contains: "Nouvelles études thermométriques," by Ch. Éd. Guillaume; "La température d'ébullition de l'eau d'après les expériences de P. Chappuis," by Ch. Volet; "Applications pratiques des interférences lumineuses à l'étude des calibres industriels et autres longuers à bouts," by A. Perard and the "Comptes rendus des Sixième et Septième Conférence Général des Poids et Mesures."

As to the *Études Thermométriques* completed about 1900, but to which Ch. Éd. Guillaume has not been able to devote time necessary for the study of the ensemble of the question and for the preparation of the memoir, it relates to the capillary action on the meniscus of the thermometer, the study of the hypsometric thermometer, and the action of various temperatures upon thermometers of hard glass, English crystal, and of Jena glass, as well as comparisons of thermometers of these two latter glasses with thermometers of hard glass.

The short memoir of Ch. Volet relates to the temperature of boiling of water under pressures in the neighborhood of atmospheric;

he reaches the conclusion that the experiments of Regnault ought not to serve as a guide to this question, and that the experiments of P. Chappuis are very close to the truth.

As to the memoir of A. Perard, it treats of the practical verification of industrial gages and of new instruments devised to make such determinations.

There is not much further to be said which is not given in the report of the sixth and of the seventh conference. The international bureau is, to be precise, engaged in carrying out the decisions of the seventh conference. As a supplement to the report of the sixth conference there is a report of Ch. Éd. Guillaume upon Recent Progress of the Metric System where there is noted the extension of the metric system especially in Asia, which was emphasized even before the conference of 1927.

WORLD ENGINEERING CONGRESS

(Tokyo, Japan)

The World Engineering Congress at Tokyo during October and November, 1929, was a notable international event—the first international gathering on engineering ever held in the Orient. There were present 3,750 delegates, representing 29 countries, and 812 technical papers were presented, covering every branch of engineering and industry.

The results are being published in 20 bound volumes comprising 16,500 pages, and will be distributed by the Kosei-Kai Publishing Office, Yuraku-Kan Building, Maranouchi, Tokyo. Standardization was discussed in connection with general problems concerning engineering, the papers being printed in Volume II of the proceedings.

INTERNATIONAL ASTRONOMICAL UNION

At the third general assembly of the International Astronomical Union in July, 1928, it was recommended by the wave-length commission "that vacuum-arc and furnace spectra be investigated carefully to determine if their use will improve the system of secondary standards." An important contribution to this subject has since been reported in a paper on Wave Lengths and Atomic Levels in the Spectrum of the Vacuum Iron Arc, appearing in the publications of the Allegheny Observatory, Vol. VI, No. 11. Some 600 lines extending from 2,800 to 8,800 Å have been measured by simultaneous exposure with neon with a median accuracy of 1 part in 5,000,000. About 1,200 additional wave lengths have been computed for the vacuum arc on the neon scale between 2,100 and 9,000 Å.

Another contribution to spectroscopic standards has been completed at the Bureau of Standards and is being published as a research paper entitled "Interference Measurement in the First Spectra of Krypton and Xenon." About 40 of the stronger lines in each spectrum have been compared with neon standards and the errors in relative value of the wave lengths as tested by "constant differences" in wave number appear to be only 1 part in 20,000,000 on the average.

PROPOSED INTERNATIONAL CALENDAR—PROGRESS IN ITS SIMPLIFICATION

Furnished by Dr. Charles F. Marvin, Chief, United States Weather Bureau

Those who have followed the discussion of this question in previous issues of the yearbook will remember that simplification of the calendar has been under active consideration by astronomers, chambers of commerce, business organizations, and scientific societies for more than a score of years past, culminating in 1923 when the League of Nations appointed a Committee of Enquiry on Calendar Simplification, which reported in 1926. Subsequently its findings were accepted by the general assembly, and under date of September 27, 1927, the secretary general addressed a letter on the subject to all nations, which for convenience of reference may be repeated here:

The Advisory and Technical Committee for Communications and Transit decides to request the secretary general of the League of Nations to invite all the administrations and organizations concerned to give the committee all information of value to it on any action taken on the suggestions contained in the report of the committee of inquiry into the reform of the calendar and, more particularly, on the proposal for the establishment of national committees of inquiry to study this reform.

Among the various nations, the United States was the first to organize a national committee, and its report was submitted to the League of Nations by the Secretary of State as of August 14, 1929.

Within the United States vigorous opposition has been aroused by certain religious groups, such as those of the Jewish and the Sabatarian faiths, to the proposed change in the calendar, which necessitates a week of eight days once in each year and twice in leap year. Late in the year 1929 the national committee for the United States sought to canvas the extent of the prevalence of religious convictions of this character among the clergy and laity of the Protestant religions. The results of this inquiry have not been fully compiled, but it is understood that they show that only a small percentage of the Protestant clergy shares the religious objections of the Sabatarian groups. (Returns show 80 per cent without objection.)

It may be well to explain here that one of the greatest defects of the present calendar is the incessant change, from year to year, of the week day name for the first day of each calendar year. This carries with it a progressive dislocation, that is a "wandering" of the successive days of the "week" with reference to definite points in the solar year. This dislocation or wandering impairs or prevents intelligent analysis and comparison of many kinds of annual statistics, especially those representing weather and other natural phenomena.

The two types of calendar simplification found acceptable to the League of Nations propose that this serious defect be overcome by giving a nonweek day name like "Yearday" to the last day of the year, and similarly in leap years to call the intercalated day "Leapday." By this proposal January 1 will always begin on Sunday, the first day of the week. This necessarily causes an interval of 7 days, instead of 6 days, between the so-called Sabbath days in the weeks in which these nonweek day names occur. In a word, at

the present time the week day names wander with reference to fixed positions in the solar year. If the week day names are fixed with reference to the points in the solar year, then necessarily the so-called Sabbath days, if they occur inexorably at intervals of 7 days, wander with reference to the day called Saturday in the simplified calendar. This wandering is deemed objectionable to certain religious faiths, but, as mentioned in the above canvas, these appear to be distinctly in the minority. It may be mentioned here that this aspect of calendar change was thoroughly considered by the League of Nations. Moreover, in 1923, when the Orthodox Churches of Greece and other eastern nations adopted the modern European calendar, it was distinctly agreed in Ecumenical Council that, although those churches would prefer a calendar conserving the continuity of the week, nevertheless the occasional interruption of the continuity of the Sabbath to secure a calendar with every year beginning on the same week day involved no question of religious dogma or canon law; therefore, they were willing to agree with other nations in the adoption of such a calendar.

The conflict on this question of calendar simplification is, therefore, purely one which involves the wishes of a very few whose religious views are not in accord with the wishes and religious views of a very large majority.

Among the organizations which went on record during the year in favor of calendar reform and the participation of the United States in an international conference were:

The Brotherhood of Locomotive Engineers.

Association of Government Officials in Industry.

Academy of Science of New Hampshire.

American Optometric Association.

Progress abroad in preparation for the international discussion of calendar reform in 1931 was considerable. Mr. Cotsworth's tour in South America, alluded to in the previous yearbook, was fruitful in stimulating the organization of national committees by a number of the Pan American States. Mr. Cotsworth explained the need of preparation for the international discussion and supplied the committees with information on the subject. He is now making a tour of Japan and other far eastern countries for the same purpose.

The action of the general assembly of the League of Nations, alluded to in the previous yearbook, which authorized the Fourth General Council on Communications and Transit to be prepared at its meeting in 1931 to consider recommendations concerning the calendar submitted by national committees and other sources, paved the way for consideration of calendar reform in 1931. At the present time the plans for the international discussion have not been fully formulated, but it is understood that a preliminary and preparatory conference, to be held in the late spring of 1931, is contemplated, and a final conference of Government delegates with full powers would be held near the end of the year in conjunction with the Fourth General Conference on Communications and Transit. It is expected that the reports and suggestions of the existing national committees will have been received at Geneva shortly, and that meantime committees representing other countries will have been formed, including

Great Britain, Canada, Denmark, and Czechoslovakia, where, in particular, preparations are being made by leading citizens. From present information it appears that 25 nations have formed their national committees, as per list below:

Europe:

Belgium.
France.
Germany.
Holland.
Hungary.
Italy.
Poland.
Sweden.

South America:

Argentina.
Bolivia.
Brazil.
Chile.
Colombia.
Ecuador.
Paraguay.
Peru.

Central America:

Costa Rica.
Cuba.
Guatemala.
Honduras.
Nicaragua.
Panama.
San Salvador.

North America:

Mexico.
United States.

INTERNATIONAL GEODETIC AND GEOPHYSICAL UNION

Contributed by J. A. Fleming, General Secretary of the American Geophysical Union

General.—The functions of the International Geodetic and Geophysical Union include consideration of what researches and standards are important in geophysical problems and stimulation of such researches and fixing of standards, both nationally and internationally. Naturally it is difficult to preserve boundaries between scientific discussion necessary to such functions and more general scientific communication such as is the field of a scientific society. The delegates to the international assemblies of the Geodetic and Geophysical Union are appointed by the various national research councils, and must be citizens of the country from which appointed. Funds for carrying on the work of the union are contributed by the various governments adhering to the statutes and thus the assemblies have a really international official status. The union's assemblies, held about every three years, bring together investigators in all geophysical branches from every part of the civilized world, and afford excellent means for the interchange of ideas and of reports of national progress, thus preventing overlapping and duplication, making possible effective coordination of the efforts in different countries, and leading to the attack and solution of many problems far wiser in extent than the boundary of a single country.

Previous reports of various activities taken pertaining to standards, standard instruments, and nomenclature by this organization in geodetic and geophysical fields are given on pages 20 to 24, 36 to 40, and 22 to 25 of the Standards Yearbook for 1928, 1929, and 1930, respectively.

Publications of transactions, of resolutions adopted, and of scientific papers and reports for the various assemblies of the union and its sections or associations may be procured through the general secretary of the union (Brig. H. St. J. L. Winterbotham, War Office, London, S. W. 1, England) or through the secretaries of seven associations among which the activities of the union are divided. These are: Geodesy, Général G. Perrier, 78 rue d'Anjou, Paris (8^e), France; seismology, Prof. E. Rothé, 38 boulevard d'Anvers, Strasbourg (Bas-Rhin), France; meteorology, Capt. Ph. Wehrlé, 176 rue de

l'Université, Paris (7°), France; terrestrial magnetism and electricity, Dr. Ch. Maurain, 191 rue Saint-Jacques, Paris (5°), 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.

Thus far, four assemblies of the international body have been held, namely, at Rome in 1922, at Madrid in 1924, at Prague in 1927, and at Stockholm in 1930. The next assembly is to be held at Lisbon, Portugal, in 1933.

Stockholm Assembly.—During August 14 to 23, 1930, at the fourth assembly in Stockholm, Sweden, some 302 delegates and guests represented 36 countries. The United States was represented through the attendance of 16 official delegates and 4 official guests—a total delegation of 20 and only 1 of whom could not be present in person.

At this assembly new statutes for the union to be effective in 1931 at the close of the present 12-year convention of the International Research Council, of which the union is a part, were discussed and prepared. Other important matters upon which action was taken by the assembly included:

1. Approval of the project for a Jubilee International Polar Year 1932-33 as proposed by the Commission on Terrestrial Magnetism and Electricity of the International Meteorological Committee. The developments of apparatus and methods of recording, as well as of new means of scientific approach and observations concerned with geophysical problems since the International Polar Year of 1882-83, are such that any concerted international effort for the prosecution of a simultaneous program of geophysical observations will yield data of incalculable value in the study of problems of geophysics. The proposal for a Jubilee International Polar Year 1932-33 by the Commission on Terrestrial Magnetism and Electricity of the International Meteorological Committee was given, therefore, the approval and support of the union in the following resolution favorably recommended by the Associations of Terrestrial Magnetism and Electricity and Meteorology:

The union accepts the invitation of the International Meteorological Committee to cooperate in organizing and carrying out a second Polar Year with a similar object to that of the first Polar Year 1882-83, and appoints the following commission for this purpose: Störmer (chairman), Chapman, la Cour, Maurain, and Wehrlé.

2. It was agreed that every means should be promoted to affect the cooperation of the International Research Council and its unions with societies, associations, or institutions engaged in work that extends beyond national lines. This action was taken because of the many organizations engaged in geophysics which extend beyond national lines and yet which are not at present coordinated with the work of the International Geodetic and Geophysical Union as, for example, the Pacific Science Congress, the Baltic Geodetic Association, the Pan-American Institute of Geography and History, the International Committee for the Exploration of the Sea, the International Hydrographic Congress, and many others. Geophysical sciences and data will be materially advanced by effective means promoting cooperation of the International Research Council and its unions with such societies, associations, and institutions.

3. Provision was considered to bring about more effective distribution of publications of the union and of each of its associations. Thus coordination and understanding of the efforts of various national societies will be forwarded through systematic distribution of complete files of publications to each national organization and to representative libraries for reference purposes.

The proceedings of the meetings of the seven associations center around agenda prepared by the executive committees of each and based upon reports and suggestions from the national committees

which are published and distributed well in advance of an assembly. The following paragraphs briefly summarize the proceedings of each association with particular reference to actions involving standards, instruments, procedure, and resolutions.

Association of Geodesy.—Activities as regards standards are indicated by the following partial list of 17 standing and special committees submitting reports: Intensity of gravity; latitude; projection; earth tides; specifications for triangulation and base measurements; specifications for first-order leveling; longitude; and bibliography. Specifications for first-order triangulation and first-order leveling were adopted following the reports of the special committees on these subjects. An outstanding feature was the report submitted by Dr. F. A. Vening Meinesz, of the Dutch Geodetic Commission, on his gravity-at-sea work in the vicinity of the East Indies. The standardized type of triangulation tower developed by the United States Coast and Geodetic Survey in the Bilby portable steel tower used since 1927 was also the subject of report.

Among the resolutions adopted were: (1) Commending the navies of Holland and the United States for making possible determinations of gravity at sea and expressing the hope that additional work might be done in the Indian Ocean and to the east of the Philippine Islands and Japan; (2) recommending the execution of such triangulations as may be necessary to have an arc extending east and west across Europe approximately along the forty-fifth parallel of latitude with probable eventual extension of this arc eastward across Asia; (3) advocating connections of the triangulations of the Philippine Islands, of the various islands of the East Indies, and of Australia since the results of such connections would be valuable not only in charting and mapping the areas involved, but also of great scientific use in studying isostasy and the shape of the geoid.

Two different types of apparatus for the determination of gravity were exhibited and described, one designed by Dr. P. Lejay, S. J., of the Zi-ka-wei Observatory in China and the other by Dr. Gustaf Ising, of Sweden.

Association of Seismology.—The national reports submitted showed fine progress being made in seismological countries, those of Denmark, Spain, Japan, and the United States being especially noteworthy.

The subject of an international catalogue of seismic stations was discussed, but no action was taken since the National Research Council of the United States has in preparation the revision of its 1921 catalogue of such stations. A new code for transmission of earthquake messages, presented by Dr. H. Labrouste of France, was agreed to. Publication of travel-time tables and curves of Dr. James B. Macelwane, S. J., after revision by him, was authorized.

In view of the expected increase in funds available to the association, it was agreed that there should be maintained hereafter a central bureau at Strasbourg, that the International Seismological Summary at Oxford should be continued, and that aid should be extended in special studies.

Among the reports submitted, the following were particularly noteworthy: On microseisms, on wave transmission and interpretation of records, on significance of earth tilts, on probable errors of

time determinations for a large number of seismograph stations, and on recent performances of the Wood-Anderson seismometer and the Wenner seismometer. A strong-motion instrument designed by Wenner was also discussed.

Association of Meteorology.—Among the resolutions concerned with the standardization and nomenclature may be mentioned the following: Nature of meteorological data indispensable for the synthetic characterization of the climate of a given locality; necessity of standardizing pluviometric instruments and methods; publication of 18 reports on the practice of weather forecasting; definition of the work of the association as chiefly discussion of scientific questions without intention to replace the usual means of publication of scientific ideas; request for consideration to the International Meteorological Committee of possibly including in publication of daily observations the data necessary for the calculation of the entropy of the air; importance of defining the turbidity of the air in a simple quantitative manner in order that it can be easily used in synoptic studies and eventually included in wireless issues; approval of general program of research on the problem of atmospheric ozone and the appointment of a subcommission on this subject; importance of a final conclusion for the establishment of an absolute pyrheliometer; welcoming the establishment in Trappes through the help of the Czechoslovakian Government of a central actinometric institute to cooperate with institutes at Stockholm, Potsdam, Washington, and Parc St. Maur in investigations for the production of a standard actinometer; recommendation for publication of a bibliography of works on radiation; recommendation that systematic observations of rains of mud in regions where they are not rare and the collaboration of meteorologists and mineralogists to determine (*a*) frequency of the phenomenon, (*b*) origin of the dust in the path of the particles, (*c*) variations in the composition of the mud either by progressive sedimentation in the atmosphere or as a function of the location relative to dust currents, (*d*) class of clouds associated with the phenomenon and their direction, and (*e*) accompanying optical phenomena; relations between the extension of polar ice and the seasonal character of the weather over large areas in connection with oceanography, with a recommendation that information be developed on this subject by means of an international organization, particularly during the Polar Year; recommendation that researches on sounding by atmospheric balloons be pursued in different countries in view of the interest of such researches from the viewpoint of dynamic meteorology, and inviting the attention of the International Scientific Radio Union to this matter and the interest of its commission on atmospheric electricity in organizing an international network for recording atmospheric electricity, especially during the Polar Year. A number of other resolutions related particularly to the Polar Year as stated elsewhere in this note.

Among the commissions of the association may be mentioned the commission on solar radiation and the commission to consider the use of geopotential in geophysical sciences as the vertical coordinate in the representation of the position of a point with reference to the earth for the purpose of geodynamic problems. As the latter commission is one in which the other associations of the union are concerned, it includes a member from each association.

Association of Terrestrial Magnetism and Electricity.—The meeting devoted considerable attention to applied and theoretical economic aspects of the association's activities. These included the application of geophysical principles to the investigation of the earth's crust and development of machine-methods to facilitate the complex computations and compilations required in studying accumulated data from many observatories. Much attention was also given the proposal for the Jubilee Polar Year of 1932-33 by the Polar Commission of the International Meteorological Committee, and the desirability of adherence in the undertaking of all governments was stressed.

Detailed progress-reports of magnetic operations were received from 20 countries. Special committees appointed were: Committee to consider existing and desirable distribution of magnetic and electric observatories and to consider plans for better coordination of efforts of all the interested organizations; committee to plan for and to secure well-distributed secular-variation data; and a committee to be appointed jointly by the associations of seismology, geodesy, and terrestrial magnetism and electricity to collaborate in the solution of problems in geology through geophysics.

The report of the special committee on the preparation of a photographic atlas of aurora with type-descriptions and instruction for the purpose of visual observation was received and approved, and authority was given that copies of the atlas be distributed without charge to observatories and organizations where worth-while auroral observations might be made. Following the report of the special committee on criteria of measures of magnetic activity, the formulas for characterization of days $(HR_H + ZR_Z)/10,000$ or $(NR_N + WR_W + ZR_Z)/10,000$ were adopted, where R represents the absolute daily range of the element indicated for the Greenwich day, and arrangements were proposed that such data be published by the International Commission of Terrestrial Magnetism and Electricity in its regular publication of magnetic character of days.

The importance of standardizing ion counters was agreed to and the Department of Terrestrial Magnetism of the Carnegie Institution of Washington was appointed as a central office to which matters could be referred pertaining to ion counters for compilation, discussion, and determination of the standard. The importance of continuing comparisons of standard electromagnetic instruments of various governments was emphasized, as also the design of portable apparatus of this character. It was agreed that the various suggestions on the subject of a uniform terminology be published for further consideration. The importance of adding to the program of certain observatories observations of atmospheric electricity and of earth-current work was unanimously voted.

Following discussion of the electric field of the atmosphere, it was agreed that tabulations to determine electric character of day might best be limited to electrically calm days. The adoption of Greenwich mean time for the publication of magnetic data was referred for further consideration to a special committee.

A report by a special committee on international collaboration for the advancement of studies of the influences of the moon on geophysical phenomena was favorably considered, and a plan for the assembling of data making use of Hollerith methods for compilations

was noted and satisfaction expressed that a practical trial of the application of this method was in prospect, thus paving the way for a definite proposal for international cooperation later. A reporter was appointed to summarize the progress in the study of theories in terrestrial magnetism.

Among the communications of particular interest was one on the direct recording of air-earth current at the Kew Observatory by the C. T. R. Wilson method; such records may be compared with indirect determinations through the records also being made of the conductivity and potential gradient of the atmosphere.

As regards the overlapping of the work being done by the Association of Terrestrial Magnetism and Electricity and the Commission on Terrestrial Magnetism and Electricity of the International Meteorological Committee, it was unanimously agreed upon that it is not necessary to set a rigorous definition of the domain of each organization, as no difficulties have been met with in practice and no unnecessary duplications have been encountered, and as the respective officers can continue their effective cooperation in avoiding these.

As a result of the joint meeting of the Associations of Meteorology and of Terrestrial Magnetism and Electricity and the deliberations of a special joint committee, the resolution adopted by the General Assembly regarding the Polar Year 1932-33 as above quoted was adopted. Other resolutions proposed by the joint committee were adopted by the association. One emphasizes the very great importance for the advancement of geophysical science for the Polar Year as planned and its approval that the observations should not be confined only to polar regions. The association, realizing the desirability that all cameras, plates, and spectroscopes used in the observations of the aurora should be of equal sensitivity, voted 15,000 gold francs for the provision of instruments of a standard type. It was further unanimously resolved that all observations should be reduced according to an agreed plan and that the Commission for the Polar Year should consider the best method for making the detailed results available for all those interested, further suggesting that all published volumes should be put on sale and that the various associations of the union should subscribe for a number of copies.

The importance of study of the correlation of the reception of wireless signals and geophysical phenomena was referred to two joint meetings of the union with the International Scientific Radio Union held August 18 and 19 at Stockholm, the association expressing itself as approving any program assuring the broadcasting of cosmic phenomena to facilitate the study of correlations concerning radio communication and the magnetic and electric condition of the earth.

Association of Oceanography.—The resolutions adopted by the American Geophysical Union, May 2, 1930, relating to physical oceanography in all oceans, especially in the vast expanse of the Pacific Ocean, and in view of the unexpected and regrettable interruption of the extremely important scientific work so successfully inaugurated by the *Carnegie*, urging all organizations inter-

ested in the science of the seas to cooperate in securing the means necessary to insure the vigorous prosecution of this work, were considered and the motion unanimously taken to do everything possible along the lines suggested.

Various communications related to oceanographic work done on various expeditions, the deep water of the Pacific, the distribution of oxygen in the Pacific as an index to the circulation of the water, the phosphate content of the water in the Pacific as an index of circulation, the origin of the deep water of the Pacific, apparatus for determination aboard ship of the salinity of sea water by the electrical conductivity method, the determination of azotized compounds of sea water, and bathymetric charts of the oceans.

The association unanimously expressed itself favorable to the creation of a commission consisting of oceanographers interested in the publication of a general bathymetric chart of the oceans, this commission to be constituted and assembled by the International Hydrographic Bureau. The national committees were asked to elect one or two persons competent to report results of all cruises having hydrographic or fishery aims executed by different countries, these results to be published twice a year by the central bureau of the association. Publication of list of international treaties and conventions with regard to oceanographic and scientific questions dealing with safety on the sea and fishing was authorized with the understanding that the proofs of the publication would be sent to the various national committees to be edited and corrected before publication. A commission was appointed to deal with question relating to the preparation of an encyclopedia of oceanography. Proofs of a handbook for scientific observations at sea prepared by a special commission were considered and the preparation of additional volumes of a handbook was assigned to the commission on the encyclopedia. The continuation of the publication of a general bibliography of the sciences of the sea, already initiated by Professor Magrini, was authorized.

Association of Volcanology.—At the time of preparing this summary (November 10, 1930), no detailed report of the proceedings of the Association of Volcanology had been received.

Association of Hydrology.—Among the more important matters discussed was the report on the measurement of glaciers in Europe submitted by the Commission on Glaciers. With this, considerable discussion was also given limnological observations, snowfall and rainfall observations, observations of subterranean waters, and gaging of streams.

AMERICAN GEOPHYSICAL UNION

Contributed by J. A. Fleming, General Secretary of the American Geophysical Union

The eleventh annual meeting of the American Section of the International Geoedetic and Geophysical Union, namely, the American Geophysical Union, was held in Washington May 1 and 2, 1930. The transactions and subjects discussed at that meeting may be summarized as follows:

General Meeting of the Union.—In addition to resolutions eulogizing the memory of five deceased members and a resolution expressing grief and regret over the tragedy in the loss of the ship

Carnegie, the following resolutions pertaining to physical oceanography, Jubilee International Polar Year of 1932-33, and an additional seismological station in South America were unanimously adopted:

Whereas, In view of our present inadequate knowledge of the physical oceanography in all oceans, especially in the vast expanse of the Pacific Ocean, and in view of the unexpected and regrettable interruption of the extremely important scientific work so successfully inaugurated by the *Carnegie*, be it

Resolved, That the American Geophysical Union urges all organizations interested in the science of the seas to cooperate in securing the means necessary to assure the vigorous continued prosecution of this work, and be it further

Resolved, That copies of this resolution be sent to the Secretary of the United States Navy with copies for the Hydrographic Office, the Naval Research Laboratory, the Naval Observatory, and the Bureau of Aeronautics; the United States Coast Guard; the United States Coast and Geodetic Survey; the United States Bureau of Fisheries; the Oceanographic Committee of the National Academy of Sciences; the Woods Hole Oceanographic Institution; the Scripps Institution of Oceanography of the University of California; the Museum of Comparative Zoology of Harvard University; the Buffalo Museum of Science; the Carnegie Institution of Washington; the International Committee on Oceanography of the Pacific of the Pacific Science Association, with copies for transmission to each chairman of the national committees; the British Admiralty; the Deutsche Seewarte; the Hydrographic Office of Japan; the Marine Biological Laboratory of the United Kingdom; the Institut für Meereskunde; the International Fisheries Commission; the Section of Oceanography of the International Geodetic and Geophysical Union; and the International Hydrographic Service.

Whereas, The International Committee of Meteorological Directors has through its Commission on Terrestrial Magnetism and Atmospheric Electricity and its Commission for the Réseau Mondial and Polar Meteorology proposed a Jubilee International Polar Year for 1932-33, this being the fiftieth anniversary of the first International Polar Year, and has appointed a commission for the Polar Year 1932-33, and

Whereas, The scientific work planned for the stations proposed during this polar year is of large geophysical interest particularly in terrestrial magnetism, atmospheric electricity, and meteorology, therefore, be it

Resolved, That the American Geophysical Union favors the proposals for an International Polar Year 1932-33 and recommends that the International Geodetic and Geophysical Union support the undertaking; and be it also

Resolved, That the American Geophysical Union strongly indorses the proposal that the United States Government take part in the establishment of certain stations for the Jubilee International Polar Year 1932-33; and be it further

Resolved, That copies of this resolution be sent to the President of the United States, the President of the Senate, the Speaker of the House of Representatives, and to the executive officers of those departments of the Government of the United States which are concerned in the scientific character of the work which is proposed for the Jubilee International Polar Year 1932-33, as well as those private research organizations which are interested, and to the International Committee of Meteorological Directors, its Commission on Terrestrial Magnetism and Atmosphere Electricity, its Commission for the Réseau Mondial and Polar Meteorology, and its Commission for the Polar Year 1932-33.

Whereas it is important that additional seismological stations equipped with modern instruments be established in South America; and

Whereas the Magnetic Observatory of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington at Huancayo, Peru, because of its trained personnel, is in a position to operate seismographs and transmit promptly reports of earthquakes without material additional expense; and

Whereas a station at this observatory, because of its southerly geographical position, would furnish data of great importance in the location of epicenters and for other seismological investigations: Be it

Resolved, That the American Geophysical Union expresses the hope that the Carnegie Institution of Washington may find it possible to equip the Huancayo Observatory with modern seismological instruments.

"The advisability of geophysical investigations in the arctic by submarine" was the subject of an address by Sir Hubert Wilkins, and was discussed particularly with reference to what geophysical observations were most needed that might be undertaken on his proposed arctic expedition by submarine in 1931. A series of six papers was presented in a general symposium on "The utility of geophysics," including the subjects of geodesy, seismology, meteorology, terrestrial magnetism and electricity, oceanography, and volcanology.

In addition to the six sections indicated in this symposium, authority was given for the formation of a seventh section on hydrology.

Section Meetings.—Reports and actions taken at the individual meetings of the various sections may be summarized as follows:

Progress reports on work in Canada, Mexico, and the United States, on methods for the precise measurement of time and determination of gravity, and on correlative studies of latitude-variations featured the meeting of the Section of Geodesy. In view of common interests, the Section of Seismology, after a short business session May 1, met jointly with the Eastern Section of the Seismological Society of America on the morning and afternoon of May 5 at the Bureau of Standards and May 6 at the Georgetown University; six of the papers were presented by members of the union and a symposium on the publication of earthquake data was led by Harry Fielding Reid, of the union. The Section of Meteorology discussed the relation between the Section of Meteorology of the International Geodetic and Geophysical Union and the International Meteorological Committee, as well as reports on units of time, solar radiation, details of instruments, data required for indicating the climatological character of a region, and a final report on the Bulletin on Meteorology in the series "Physics of the Earth" to be published by the National Research Council. The papers given before the Section of Terrestrial Magnetism and Electricity dealt with the proposed International Polar Year 1932-33, the significance and importance of continuance of magnetic and atmospheric-electric observations on the oceans with accounts of instruments suitable for work at sea, secular variations in the United States and over the Earth's surface, and possible relationship of earth movements and terrestrial magnetic variation and of the aurora and the Earth's magnetism. The Section of Oceanography had two sessions, one May 1 and a second May 2, hearing papers concerned with oceanographic work in its various phases and particularly with relation to physical oceanography and its relations to marine biology and meteorology. The program of the Section of Volcanology dealt with volcanic activity and the central African volcanoes.

Miscellaneous.—The transactions of the tenth and eleventh annual meetings were published in June, 1930, in a special bulletin of the National Research Council containing 314 pages. Information regarding this and other publications of the American Geophysical Union may be secured from the general secretary, J. A. Fleming, 5241 Broad Branch Road NW., Washington, D. C.

The union submitted for consideration at the Stockholm assembly of the International Geodetic and Geophysical Union a number of recommendations, all of which were favorably acted upon at that assembly. Briefly these were:

(a) Recommendation for the establishment of a program of broadcasting of information regarding magnetic and electric conditions; (b) approval of the project for a Jubilee International Polar Year 1932-33 as proposed by the Commission on Terrestrial Magnetism and Atmospheric Electricity of the International Meteorological Committee; (c) appointment of a joint committee from the associations interested on the application of geophysics to the solution of geological problems; (d) consideration of means to promote the cooperation of the International Research Council and its unions with societies,

associations, or institutions engaged in work that extends beyond national lines; (e) provision for distribution of geophysical publications of the International Union and its associations insuring complete files for reference in each national union and a supply for distribution by each national Union.

INTERNATIONAL GEODETIC ACTIVITIES

Furnished by United States Coast and Geodetic Survey

A geodetic project of international value and importance, although carried on by only one country (Holland), has been the determination of gravity at sea at more than 200 stations in the Indian Ocean and in the waters of the East Indies during the past year. A few gravity-at-sea determinations were also made in the Pacific Ocean by the ill-fated nonmagnetic ship, the *Carnegie* of the Carnegie Institution of Washington, during the months just prior to the destruction of the ship by fire. Several other countries realize the importance of gravity work at sea and are planning to take part in the work as soon as instruments have been obtained and arrangements have been made for the use of submarines on which such work is usually done.

During the spring of 1930, the United States Coast and Geodetic Survey cooperated with the International Expedition to the Bahamas under the auspices of Princeton University, which is making a scientific study of the Bahama Islands, by determining gravity at six stations on the islands at the northwestern end of the group. These stations supplement a number of gravity-at-sea stations in the adjacent waters which were determined in 1929 by the United States Navy, in cooperation with Dr. Vening Meinesz, of Holland, and the Carnegie Institution of Washington.

Through cooperation between the United States Coast and Geodetic Survey and the Geodetic Survey of Canada, first-order triangulation, based on the 1927 adjustment for the western half of the United States, has been extended into Alaska. This is only one item of a large amount of cooperative work carried on by those two organizations and largely made possible by standardization of methods and instruments.

In preparation for the triennial meeting of the Section of Geodesy of the International Geodetic and Geophysical Union, to be held in Stockholm, Sweden, in August, 1930, the geodetic organizations of the many countries adhering to that union have prepared special reports outlining the geodetic accomplishments of each country during the 3-year period since the previous meeting and making recommendations in regard to desirable international cooperation on special projects and in regard to standardization of instruments and methods. Geodetic operations of all kinds are greatly aided by these triennial meetings and by the activities of international committees which work during the interim between meetings of the union. Numerous technical papers, dealing with geodetic subjects, appear in the *Bulletin Géodésique*, a periodical issued by the Paris office of the Section of Geodesy, and a ready exchange of information among various countries is thus promoted.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

(28 Victoria Street, Westminster, London, England)

Furnished by Clayton H. Sharp, President United States National Committee of the I. E. C.

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 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, radio communication, 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 letter symbols for scientific and engineering quantities), steam turbines, hydraulic turbines, internal-combustion engines, and rating of rivers.

The terms of appointment of members of the United States National Committee having expired with the holding of a plenary meeting of the commission, the constituent bodies have made new appointments without, however, changing the personnel of the committee to any large extent.

At a meeting of the United States National Committee, held on October 28, Dr. Clayton H. Sharp, Eightieth Street and East End Avenue, New York, N. Y., was reelected president and Dr. Harold S. Osborne, 33 West Thirty-ninth Street, New York, N. Y., was reelected secretary-treasurer. The committee is continuing its work in a routine manner.

During 1929 meetings of Advisory Committees of the International Electrotechnical Commission were held as follows:

Advisory Committee No. 2 on Rating of Electrical Machinery, July 10-12, 1929, in London.

Advisory Committee No. 9 on Electrical Traction Equipment, July 8 and 9, 1929, in London.

Advisory Committee No. 7 on Aluminum, November 6, 1929, in Berlin.

Advisory Committee No. 13 on Electrical Measuring Instruments, November 6 and 7, 1929, in Berlin.

The Seventh Plenary Meeting took place from June 27 to July 9, 1930. The opening meetings were held in Copenhagen, the meetings of the advisory committees were held in Stockholm, and the final meeting to approve the work done was held in Oslo. Professor Enström, of Sweden, was elected president in succession to Professor Feldman, the retiring president. It was decided to hold the next

eight plenary meeting in Czechoslovakia in 1934. About 300 delegates representing 22 countries took part in the meetings of 17 advisory committees which dealt with the various subjects. Thirty-two delegates represented the United States National Committee.

The following is a brief summary of the accomplishments of the above meetings and of current standardization projects.

Nomenclature.—There is under preparation a comprehensive vocabulary of technical definitions in French and English. 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.

A particularly important action was the official adoption by the I. E. C. at the Stockholm meeting of the following names for the magnetic C. G. S. units: Magnetic flux, *maxwell*; flux density, *gauss*; magnetic field intensity, *oersted*; magnetomotive force, *gilbert*.

Electrical Machinery.—Agreement to a revised standard, which is subject to final review and ratification by the various national committees, was reached at the Stockholm meeting.

Symbols.—Graphical symbols for radio communication and a revision of Publication 35 dealing with graphical symbols for heavy-current systems were adopted. Certain symbols relating to telephones and telegraph were also approved but the list will be made more complete later in collaboration with the Comité Consultatif International pour la Télégraphie, should this committee forward any proposals for discussion. A small subcommittee was appointed to draw up proposals for symbols for electric traction. The various national committees were requested to submit lists of symbols in use in their countries in connection with relays and other automatic devices, preparatory to standardization.

Steam Turbines.—A document was completed and approved. It will consist of two parts comprising:

Part I. Specifications:

Appendix A. Information to be supplied with inquiry or order for steam turbines.

Appendix B. Suggested standard ratings of steam turbines.

Appendix C. Suggested standard boiler steam pressures.

Appendix D. Graphical symbols for steam turbine plant layouts.

Part II. Rules for acceptance tests:

Section 1. Object and scope.

Section 2. Enumeration and description of terms, including letter symbols for heat and thermodynamics.

Section 3. Guiding principles.

Section 4. Mandatory rules for instruments and methods of measurement.

Section 5. Computation of result.

Section 6. Report of tests carried out in accordance with I. E. C. rules for acceptance tests.

Further consideration will be given to an appendix to be added later to Part II comprising informative data relating to instruments and measurements and which is intended to be supplementary to the rules as adopted.

Lamp Caps and Sockets.—Agreement was reached concerning most of the essential dimensions of the bayonet cap and the medium, flashlight (miniature), and Goliath (Mogul) Edison screw caps. Certain unsettled questions were referred back to a subcommittee, which was authorized to submit its decisions for ratification to the International Commission on Illumination, which will hold a meeting in September, 1931. It is expected that these recommendations will come up for final approval of the I. E. C. at its next plenary meeting.

Aluminum.—The adoption of an international standard for hard-drawn aluminum was postponed on account of failure to agree upon a standard value for the resistivity regarding which American and European practices are different. Investigations are being made preparatory to the establishment of standards for annealed aluminum wire.

Standard Voltages and High Voltage Insulators.—It was decided not to add 132 kv to the list of standard voltages published by the I. E. C. in Publication 36, but to provisionally adopt 400 kv.

As regards insulators, agreement was 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.

The meeting asked the National Committees to approve, under the six months' rule, taps of plus and minus 4 per cent for distribution transformers with primary voltages less than 60 kv.

Electric Traction Equipment.—Considerable progress was made toward completing standards for traction motors. The various national committees were asked to submit proposals regarding other apparatus used in traction systems, including mercury arc rectifiers, also data regarding overvoltages of the power supply.

Insulating Oils.—Certain principles for making tests were agreed upon, which will be formulated into a code, after which 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 were accepted for adoption under the six months' rule.

For international purposes viscosity will be expressed in kinematic centipoises.

Rules and Regulations for Overhead Lines.—Study and comparison of the rules in force in various countries was continued. A proposal relating to the calculation of the mechanical stability of conductors was discussed at length, but no final conclusion was reached. Replies from the national committees relative to principles underlying the program for future work were read and discussed. These views will be collated and distributed to the national committees.

Radio Communication.—Agreement was reached as regards certain dimensions of tubes and bases, and connections and other requirements for bases. Tentative recommendations were made regarding standard directions of rotation for switches and other controls. Proposed safety regulations were reviewed concerning which further discussion will take place. The advisability of estab-

lishing a committee to study nonradio electrical interference with radio reception was referred to the national committees. A comparison was made of the letter symbol in use by various countries for the amplification, slope, and internal resistance with a view to standardization later. The committee considered that the time is ripe to undertake to define the general lines of acceptance specifications for radio tubes. These would apply to both receiving tubes and power tubes and would include definitions, data to be specified in purchasing tubes, selection of samples, and test methods in general terms. The subject of the proposed specifications was referred to the national committees for study.

Measuring Instruments.—Specifications for two classes of a. c. watt-hour meters and two classes of current and voltage transformers more especially intended for use with watt-hour meters were approved.

Rating of Rivers.—Bases for computing and units for expressing waterpower resources for statistical use and for the purpose of making comparisons between different rivers, river basins, regions, and countries were adopted.

Shellac.—It was agreed to enlarge the scope of the committee to include lac and synthetic resins for insulating purposes. Various tests, including tests to determine rosin and ash content, were considered. Further proposals for research and methods of test are solicited from the national committees for consideration at the next meeting.

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 the committee to include a definition of the direction of rotation, indications of transformer diagrams, and colors for polarity of batteries and for conductors was requested.

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

Internal-combustion Engines.—The Stockholm meeting being the first meeting on this subject the attention of the committee there was given to reviewing the proposals of the various countries and to reaching agreement as to what subjects would be given the first consideration.

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 this committee should be formed, for each meeting, of experts representing governments or radio operating companies. Its function should be to advise the radio administrations of the world on technical radio problems.

The first meeting was held at The Hague, Holland, in September, 1929. Agreements were reached on recommendations on a wide variety of technical radio problems, including such important subjects as the standard frequency separation of assigned radio-frequencies, and the tolerances to be permitted in the frequency variation of transmissions from radio stations. It was decided that the next meeting would be held in Copenhagen, Denmark, in May, 1931. In the summer of 1930 an American committee was organized under the auspices of the Federal Radio Commission, at the request of the State Department, to prepare United States proposals for the Copenhagen meeting. This committee prepared, in behalf of the United States, recommendations on the following questions, which are on the agenda for the meeting in Copenhagen:

First question.—Organization of a commercial radiotelephone service between mobile stations and the land networks.

What are the most suitable methods, from a technical standpoint, to insure the good organization of a commercial radiotelephone service, especially long distance, connecting mobile stations—and particularly passenger-carrying vessels—to the public telephone networks?

Second question.—Coordination of radiotelephony between fixed stations with the telephony on the land networks.

Coordination of radiotelephony between fixed stations with the telephony on the land networks, particularly as concerns the following questions:

(a) What is the most suitable method for measuring noise levels under the special conditions of a radiotelephone circuit?

What should be the maximum tolerable limit of the noise level measured by this method?

(b) What instrument would be suitable to permit the special operator who is situated at the junction point between the radiophone connection and the metallic circuit to measure the voice level?

Third question.—Stabilization of transmitters.

The study and perfecting of methods technically available for maintaining constant the stability of a transmitter.

Fourth question.—Comparison of frequency standards.

The study and perfecting of methods for the comparison of frequency standards.

Fifth question.—Calibration of wave meters.

Sixth question.—Reduction of interference in shared frequency bands above 6,000 kc.

The study of methods to be adopted to reduce interference in the bands shared by fixed and mobile above 6,000 kc (wave lengths below 50 m).

Seventh question.—Reduction of the frequency band of a transmitter.

The study of technical possibilities of reducing the frequency band occupied by a transmitter, by the partial suppression of the frequency band transmitted (that is, the emission of a single side band only or of a side band and the carrier wave) for various types of transmission and types of service.

WORLD POWER CONFERENCE

The Second World Power Conference held in Berlin this summer brought together nearly 4,000 delegates from all parts of the world.

The object of this conference is international consideration of the problem of power production and utilization. The interest in standardization is secondary; nevertheless there are various phases of the general subject where matters of standardization are of prime if not of major importance. The prospectus for the conference contains the following pertinent comments on standardization:

From consideration of the above questions (referring to the subjects presented for discussion) it will be seen how important it is for their solution in the simplest and most economical manner, that simplification should be brought about by national and international standardization. Although the World Power Conference does not itself wish to carry out such standardization, the year 1930, will without doubt, provide a large range of problems to be dealt with by the appropriate standardizing organizations.

Among the items on the program which concern standardization are the following:

A memorandum was presented based on reports regarding their respective fields of activity by the International Electrotechnical Commission, the International Federation of National Standardizing Associations, and the New International Association for Testing Materials. Resolutions were presented concerning questions of nomenclature in various lines, the object of which was to promote international uniformity.

The executive council was urged to exert every effort to insure international agreement on various usages, such, for instance, as the use of either the gross or net calorific value of fuels, and the methods of defining the characteristics of liquid motor fuels.

The transactions of the conference, not yet available, will contain many items which show the predominant importance of standardization in the field covered by this conference.

INTERNATIONAL STEAM-TABLE CONFERENCE

STANDARDIZATION OF PROPERTIES OF STEAM

The second International Steam Table Conference held in Berlin during the week of June 23, 1930, was attended by two representatives of the National Bureau of Standards, who presented the results of extensive calorimetric measurements of properties of steam made at this bureau.

The substance of these results was included in the skeleton steam table, which will presently be published, as revised at this conference.

The International Steam Table Conference is the agency through which international cooperation in research is encouraging standardization of working steam tables for use of engineers, and the International Skeleton Steam Table is the instrument by which the results of study and experiment are brought together. This skeleton table consists of a set of chosen numerical values of the thermal properties of steam at certain distributed points, forming a network, which may be used as a standard for appraisal of any working table. In addition to the chosen definitive values, tolerances are chosen within which limits a given table is to agree with the skeleton table in order to be considered an international table.

The skeleton table is regarded as tentative, subject to revision by successive conferences in the light of new experimental data.

The conference is informal and unofficial, and its activities purely advisory. The countries represented at present are Great Britain, Germany, United States, Czechoslovakia, Switzerland, and Sweden.

Already the effect of international cooperation is becoming apparent in the gradual convergence of the working tables which are being brought out from time to time. The prospect is good for attainment of the ultimate goal of a complete working table of the properties of steam which by virtue of its truth will be universally acceptable.

INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

The international arrangement with the National Bureau of Standards reported in the 1929 Standards Yearbook with respect to the preparation and distribution of pure organic chemicals to scientific investigators has been continued under the direction of Dr. G. E. F. Lundell of the National Bureau of Standards, at Washington, to whom inquiries for information may be addressed.

INTERNATIONAL COMMISSION ON ILLUMINATION

The International Commission on Illumination is a federation of national committees, each of which includes representatives of the various organizations in its own country which are actively concerned with illumination. The central office of the commission is at the National Physical Laboratory of Great Britain; the 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 latest one took place in the United States in 1928. (See pp. 26 to 28, Standards Yearbook for 1929.) The 1931 session is to be in Great Britain, from September 3 to 19, inclusive. Like the 1928 session, it will be made the occasion for an International Illumination Congress. Meetings of the Congress will be held in succession in London, Glasgow, Edinburgh, Sheffield and Birmingham, concluding with meetings of the commission at Cambridge.

The technical work of the commission is assigned to 18 committees as follows: 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. For each of these technical committees the secretariat is assigned to a specified national committee which is responsible for management of the project and for the presentation of a report to the next session of the commission. The United States National Committee has this responsibility for four of the projects listed (Nos. 3, 4, 16, and 17), and has representatives on all of the other technical committees.

INTERNATIONAL STANDARDS ASSOCIATION

(Résumé of the May 19 to 28, 1930, Conferences in Paris, France, of the Association)

From Report of United States Trade Commissioner Thomas Butts

There follows a résumé of the meetings held during the Conference of the International Standards Association, held in Paris from May 19 to 28 last and organized by the Association Française de Normalisation (AFNOR).

Paper sizes.—The subject discussed was the question whether the series of metric paper sizes adopted in about a dozen European

countries are to be considered as the untrimmed or as the trimmed sizes. Holland held the former standpoint, claiming that the untrimmed sizes are the ones that count in manufacturing paper. The Germans prefer to leave the question of the untrimmed sizes to the paper manufacturers, holding that the most important thing is to have the sheets, forms, books, etc. (that is, the trimmed sizes), in a uniform size.

Holland was backed by Poland and by the personal opinion of the Italian and French delegates (in these countries, the matter had not yet been discussed). All of the other countries were in favor of considering the standard sizes as trimmed sizes. A recommendation to this effect was made, with the addition that the tolerances should be held as small as possible.

Technical Drawing.—The program of work for an I. S. A. technical committee on this subject was laid down as follows: Lettering; thickness and type of lines; arrangement of views and sections; simplified representation of screwed parts; cross-hatchings of sections; sizes of drawings and method of folding them; symbols for indicating finish of parts; method of indicating sections by lines; indication of dimensions, tolerances, and fits; and simplified representation of machine elements, such as gears, springs, etc.

It was decided that Switzerland would be recommended for taking charge of the secretariat.

The American delegate brought to the attention of the other delegates the draft standards so far worked out by a technical committee under the auspices of the A. S. A. In this connection, two points were of special interest.

First, most European standards or drafts give inclined lettering for drawings, whereas the American draft recommends vertical lettering. At the meeting, it appeared that, after all, eight countries were in favor of adopting both inclined and vertical lettering.

Second, the United States and Holland are the only countries where the third-angle projection has been adopted. All other countries favor the first-angle projection, as taught in descriptive geometry. It was recommended that the I. S. A. technical committee give this point reconsideration.

A resolution being adopted to the effect that the conference recommended unanimously that the work on the above points be taken up, the United States delegate made a statement that this did not mean, as far as the United States is concerned, that the American committee will wish to have formal membership in this I. S. A. committee. This question must be left to the decision of the American committee.

Small Tools (Twist Drills, etc.).—The French committee had asked the I. S. A. to have this subject taken up. It was so decided and the scope of the work was expanded to include also other kinds of tools. Machine tools and their elements were excluded. The scope adopted was as follows: Drills, machine tapers, threading tools, reamers, squares for tool shanks, sections of cutting tools (in connection with tool post openings, etc.), milling cutters, and nomenclature.

The French committee to take care of the secretariat, but certain subdivisions of the work to be done by other national committees,

in so far as the secretarial work is concerned. Thus, for example, the Germans would take care of the secretariat for "machine tapers."

The American delegate informed the meeting about the latest developments in the American committee on "small tools and machine tool elements," especially with regard to "machine tapers," "twist drills with cylindrical shanks," and "milling cutters."

Test Pressures for Land Boilers.—The purpose of these discussions was to see whether uniformity could be reached, internationally, in the test pressure expressed in terms of working pressure. If P be the working pressure, the United States (Boiler Code of the A. S. M. E.) specifies a test pressure of $1, 5 P$. Japan goes as high as $2 P$. All other countries have or are tending toward a lower test pressure on the ground that many boilers are damaged by a test pressure which is considerably higher than the working pressure. Initial cracks may be produced and lead to fatal results later on.

It was decided to study the matter further, as it did not seem impossible for the Continental countries to come to a uniform practice. Four countries: Germany, Switzerland, Czechoslovakia, and Holland were already very close together.

Japan was to be invited to consider whether it would not come down to the Continental figure or at least to $1, 5 P$, as the United States has.

The Czech body hold the secretariat for this work. The United States does not participate in the work and on behalf of the Boiler Code Committee our delegate made a statement that it did not wish to have formal membership in the I. S. A. committee, but would be glad to supply technical information about American developments and be informed about the European work.

Wrench Openings (Width Across Flats of Bolt Heads and Nuts).—The Swedish secretariat had worked out and submitted at the last moment a proposal for a series of new wrench openings smaller than those at present adopted in a number of European countries, such as Germany, Switzerland, Holland, Sweden, Austria, etc.

Our delegate stated that from the American standpoint there seemed to be no doubt that the series as proposed would not be considered for adoption by the American committee on "bolt, nut, and rivet proportions," an American standard having been adopted in 1927, after years of painstaking work, and recently revised at the request of the manufacturers. At present the standard seemed to be satisfactory to everybody.

In the course of the discussions it came out that the European wrench openings were so much larger than ours only because some years ago the Germans had adopted these larger heads and nuts, thinking that the so-called "U. S. standard" was really a national standard in the United States. However, in 1924 it was found that only 3 per cent of the American production was made in these sizes, most heads and nuts used in the industry being considerably smaller.

It was also stated that it was no use trying to work out a proposal for a standard on this subject, supposed to be internationally accepted, if the United States and Great Britain did not participate.

Our delegate then asked the chairman to lay the following questions before the meeting:

1. Do the American small sizes of heads and nuts, or sizes close to these, appear to be acceptable to the other committees, considered from the technical point of view? (That is, leaving aside the difficulty of making a transition from the existing standard to a new standard, whatever that standard may be.)

2. Are round millimeter sizes essential for a new series of wrench openings, in the opinion of delegates?

The answer to the first question was "yes" and the answer to the second was "no." The Swedish secretariat was asked to work out a new proposal, keeping in mind the existing American series.

Rivets.—An exchange of opinion was held between the "metric" delegates concerning a proposal worked out by the Dutch secretariat. Our delegate gave no opinion as he had not yet received the reply from the American subcommittee to whom the proposal had been submitted some months ago.

Coal.—The question of assorting coal on the basis of grain size has been raised by the Polish body. In the correspondence on this subject with the A. S. A., some confusion had been caused by the fact that "classification" and even "analysis" of coal had been spoken of. Our delegate, therefore, made the following statement:

That there were three distinct subjects; that is—

1. Assortment of coal on the basis of grain size.

2. Sampling and analysis of coal.

3. Classification of coal on the basis of its physical and chemical properties.

He showed the meeting copies of a series of technical papers read at the February, 1930, meeting in Cleveland, Ohio, of the American Society of Mining and Metallurgical Engineers.

It was decided that subjects 1 and 2 would be taken up and, perhaps, later 3. Secretariat to go to Poland.

Nomenclature and Methods of Test of Petroleum Products.—It was decided that the I. S. A. council be asked to appoint an I. S. A. technical committee on this subject and invite the American group to take charge of the secretariat. (This will be the first American I. S. A. secretariat.) This was done as suggested.

The Russians, who some years ago asked that "specifications for petroleum products" be taken up, declared themselves willing to take charge of the secretariat for this subject. The American group does not favor taking up this work too quickly (progress still being too fast and changes consequently too rapid to permit the setting up of standards at present).

Traffic Signals.—A controversial subject, a draft standard worked out by the League of Nations was the most favored and the other proposal (Dutch) was withdrawn.

Meeting of Secretaries.—Next conference fixed for September 22 to October 3, 1930, to be held in Vienna.

Plenary Meeting.—Under the plan of rotation Germany and Czechoslovakia withdraw from the council on January 1, 1931, to make way for the United States and Russia, respectively. The central office is transferred from Zurich to Basle.

III. NATIONAL STANDARDIZING AGENCIES

(Governmental)

NATIONAL BUREAU OF STANDARDS

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

(See Chapter V)

The primary function of the National 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 activity is shown by the fact that the bureau is cooperating in its standardization program with over 200 scientific, technical, and industrial organizations. At the close of the fiscal year there were also 97 research associates, representing 38 industries, and associations, at work in the bureau on research problems of interest to the industries concerned.

NATIONAL PHYSICAL LABORATORY

(Teddington, England)

During the past year the work for industrial firms and public bodies has expanded. The volume of investigations and tests for which reimbursement is made exceeded any previous year. Many industrial researches were carried out while the basic work on standards continued actively.

The work of the laboratory is carried on in seven sections—physics, electricity, metrology, engineering, metallurgy, aerodynamics, and that of the William Froude national tank.

The work on international standards originating in 1927 with the Seventh General Conference (International) of Weights and Measures, was continued. Equipment for the establishment of the wave-length standard of length including the standards has been installed. A determination of the meter in terms of the red cadmium radiation will soon be made. Preparations for determining the ohm by two independent methods—Lorenz machine and Campbell alternating-current bridge—have been continued and certain difficulties overcome. This work is an essential preliminary to the proposed international adoption of the absolute c. g. s. electrical units in place of the present international units.

In the work on the International Temperature Scale the platinum resistance thermometer scale and the Tonnelot and Baudin mercury-

in-glass thermometers have been compared and the results published. An international intercomparison of resistance thermometers and thermocouples is in progress. Instruments from the National Bureau of Standards and the Physikalische Reichsanstalt are being compared with those of the National Physical Laboratory, and the work will be repeated by the first two laboratories named. The standard optical pyrometer of the laboratory has been calibrated at the melting point of gold, and work has been done on the melting point of palladium.

Many intercomparisons have been made with other laboratories as part of the work on maintenance of standards. Among these are the measurements on resistance coils and standard cells from America, Japan, and Russia. Fifteen years of intercomparison of resistance coils show a progressive change in the relative value of the American mean ohm as preserved at the two laboratories which led to a difference of about 2 parts in 100,000. Larger differences exist between the laboratory unit and those of Germany and Russia, which will be investigated further.

International frequency comparisons show an accuracy beyond the limits of constancy of the means used. Measurements on the subdivided mica condenser from the National Bureau of Standards show that they are identical at lower frequencies, but differ at higher frequencies. A more stable capacity standard will be used in further investigation.

A number of sets of lamps covering a wide range of efficiencies and sizes have been received from America for the comparison of the values of the lumen output and efficiency obtained in the two countries.

Research on Noise.—Measurements of noise in airplane cabins during flight show that such noise is a thousand times that in an express train. The effect of speed, blade section, and blade angle on the noise of the propeller, and the effect of silencers on the noise of the motor have been studied. Preliminary studies have been made of street noises and especially the noise of motor horns.

Using the principle of Barkhausen a method for measuring noise intensity has been devised. A variable sound source is compared with the noise to be measured by the use of a telephone, and adjusted to equality. The current is varied until the telephone note is just masked by the noise. A scale of loudness given by the device has been calibrated in absolute units.

Pivots and Jewels.—An investigation of pivots and jewels yielded interesting results. Without lubricant the frictional torque remained constant at 2 dyne-cm for 500,000 revolutions, reaching 48 dynes after 22 days. With lubricant 15,000,000 revolutions was attained without appreciable change in the torque, which increased to 10 dyne-cm after 16,500,000 revolutions. The research shows no appreciable difference in initial friction with lubricant, but the useful life is prolonged from 500,000 to 15,500,000 revolutions by lubrication; that is, from 12 days to 6 months.

Research on Gears.—Research on the efficiency of power transmission by gears shows that the endurance of the teeth is determined by fatigue failure rather than by load or abrasion. Gears ground to a smooth semicircular root curve, go several times the average life of the standard tooth under like conditions.

Physics.—A magnetic field at right angles to heat flow in a single crystal of bismuth lowers the conductivity. A negative temperature coefficient was found perpendicular to the trigonal axis. The ratio of specific heats of gases is being measured by the velocity of high-frequency sound. A wet and dry bulb hygrometer for measuring moisture in timber-seasoning kilns has been built. The free moisture in fogs has been measured, and research on refrigeration problems has been continued.

The use of X-ray methods in industrial research has been the subject of research; for example, in studying the mechanism of distortion of single metal crystals involving some 50 X-ray analyses of various metals. A standard ionization chamber for the realization of the international "röntgen" (r) unit of X-ray intensity has been completed and the X-ray pastille dose has been evaluated in r -units. The radium samples tested have been greater than heretofore on account of purchases by the National Radium Trust. Electron tubes are being used to amplify ionization currents and thus facilitate comparison of radium samples. A record number of hospital X-ray departments have been inspected during the year.

Efforts are being made to measure sound intensity in absolute units, with promising results. Three methods are being used to measure particle velocity in a sound wave. The study of sound transmission through partitions has been extended to higher and lower frequencies, weight appearing as the predominant factor in sound reduction for single panels.

Various new methods of making optical settings have been devised and tested during the year, and papers have been issued dealing with skew pencils of rays and reflection caustics. Fifty-seven standard colors for ready-mixed paints have been measured, covering a schedule of the British Engineering Standards Association. These are the first published collection of colors standardized on the laboratory's colorimetric system. An apparatus has been devised for accurate visual spectro-photometry, in which two photo-electric cells are balanced against each other. The energy distribution of daylight is being determined over a year to aid in the design of a simple device for determining the variation of energy distribution in the daylight spectrum at different stations.

Precision measurements of the self-inductance and effective resistance of telephone loading calls are so important that a bridge method has been developed permitting the comparison of specially designed, fixed self-inductance standards and the coil under test. The method will be further developed for other uses. To ascertain the most suitable material for terminal boards, etc., an investigation of the effect of exposure to sunlight and light from the mercury arc on standard instruments has been made, and the surface resistivity of ebonite, heramoc, and bakelite was determined. The latter two were scarcely affected, but the ebonite was greatly reduced by a few hours' exposure to sunlight.

The methods of testing magnetic materials have been further developed. The Epstein testing set is completed, and a comparison has been made of bridge and wattmeter methods of measuring total losses at power and telephonic frequencies.

Important progress has been made on researches on power losses in dielectrics and on dielectric measurements at radio-frequencies.

Interesting results have been obtained in radio-frequency standardization.

Considerable progress has been made in improving methods of alternating-current measurement. Facilities for tests of high-voltage insulators have been added to permit testing such insulators under artificial rain, and a tank has been provided for tests in oil. Tests have been made of insulator systems, both dry and in artificial rain, several of them connected with the 132 kv national electricity scheme.

In cooperation with industry there has been produced a copper-nickel wire having a low temperature coefficient of resistance of only ± 0.00001 . The first application of this wire has been for a shielded potential dividing resistance for 40,000 volts for voltage-transformer testing, and of three air-cooled noninductive resistors giving a 2-volt drop with a current of 200 amperes, having a change in resistance of less than 1 part in 10,000 over the current range. These resistors have already proved of great value in the work on nickel-iron transformers.

An electrometer photo-electric photometer is almost completed on a permanent basis. A photo-electric photometer with a vertical bench has been made for measuring mean spherical candlepower. Talbot's law was studied with the unexpected result that the law is generally valid for nonlinear as for linear cells, as to the effect of periodic excitation of the retina at frequencies too high to give the sensation of flicker. Some new types of red-sensitive cells were found 10 times as sensitive as the older type for light from a vacuum-electric lamp, but not so constant. Photo-electric methods were used in the design of a continuous-daylight recorder, and in the measurement of the spectral transmission through colored glasses.

The determination of the yellow-blue ratio has been completed by 25 members of the staff.

Among other subjects studied were the illumination of buildings, dock lighting, and diffusion by opal glasses.

Metrology.—Preliminary results on a vibration clock designed by the metrology department of the laboratory give promise of an independent measure of time such that the accuracy of a single observation will approach $1/5000$.

Preliminary trials of a method for the absolute determination of "g" give promise of an accuracy of 1 part in 50,000.

A bench to take lead screws up to 14 feet in length has been provided, and facilities for measuring tapered plugs and ring gages up to 16 inches are now available. Research is under way to improve the properties of gage steel, and to obtain more suitable materials for gages.

A primary standard barometer has been constructed and awaits only the temperature-control devices before being put into service. Provision for the direct testing of barometers is being made.

Engineering.—The critical speed has been determined at which a vortex ring formed behind a flat circular plate at right angles to the flow of a fluid breaks up into a spiral discharge. Analysis of experimental results shows that the ball indentation test for hardness is not likely to be useful for determining elastic limit and yield stress. A large range of ball and roller bearings were tested to

determine the loads at which they were stressed beyond the elastic limit of the material.

Experiments on skidding made it possible to design apparatus for testing a full-sized chassis and balloon tires of normal dimensions. Remote electrically recording accelerometers have been designed to study the effect of wheel dimensions on road wear. Numerous researches have been in progress on the properties of specific materials. The periodic measurements of the stability of the buildings of the Tower of London and of the vibration of the building of New Scotland Yard have been continued.

Metallurgy.—X-ray photography has been applied to the study of the difference between solid solutions and intermetallic compounds. A wire-drawing calorimeter has been used to measure the heat evolved in drawing aluminum and copper wires. After a study of methods of producing single metallic crystals a large number of such crystals have been produced for use in the laboratory. The alloys research on iron and its compounds with silicon, chromium, and manganese has been continued and some of the difficulties of temperature measurement have been overcome. Interesting results have been obtained on light alloys, minor metals, and the effects of gases in steel. Cooperative work has been continued on alloys for use at high temperatures, wrought-iron chains, spring steels, and welded containers for the transport of compressed gases.

Aerodynamics.—The problems of wing and tail flutters have been further investigated, and the problems are now fully understood so that the designers can avoid the flutter. The question of air propeller flutter proves complex, but a solution is expected shortly. The problem of airplane spin is still under investigation. It is hoped to complete the new compressed air tunnel and its equipment during the current calendar year 1930. New experimental data have been obtained on the use of slotted wings.

In the research on fluid flow the tensor notation has been applied to the 3-dimensional equations of a viscous fluid and an attempt has been made to correlate with theory the results of experiments on the "boundary layer" of a cylinder in a wind stream. The intensity of skin friction on a circular cylinder has been estimated over a definite range and the effects of turbulence and surface roughness on the flow around a cylinder has been studied.

Experiments of a model of the Rock of Gibraltar have yielded important data to pilots flying in the vicinity of the rock. Automatic wind speed controls have been added to all the wind tunnels of the laboratory. The success of the British machines in the contest for the Schneider trophy is a striking instance of the value of tests on models in the wind tunnel.

William Froude National Tank.—Research on the air resistance of the above-water part of a ship's hull, including the superstructure, has included tests on models of three vessels for which data have been obtained at sea—an oil tank steamer, an express cargo ship, and a high-speed, first-class liner—the results having been communicated to the Institution of Naval Architects at their 1930 summer meeting.

Comparisons of wave resistance with results on models were also obtained. A research was made on the effects of unbalanced and

balanced rudders on the maneuvering of ships. The effect of immersion of the propeller was studied by means of a full-scale test on a collier under various conditions of draft and speed. Model tests on a family of propellers at varying immersions were completed.

Interesting comparisons were made between model and ship data for designs tested in the tank. A beginning has been made on a research to obtain data for common forms of coasters and tugs. The comparison of results on stream-line models working in air and in water has been completed.

PHYSIKALISCH-TECHNISCHE REICHSANSTALT

(Berlin, Germany)

Presidential Division: Laboratory for Radioactivity.—There were 382 radioactive preparations tested, which were intended for medicinal use, as well as a large number of weakly radioactive substances, such as ores and the like. The emanation standards (radium standard solutions) were continuously tested and 45 certified radium standard solutions distributed. Researches on the measurement of very weak gamma radiation by the automatic counting of the deflections of a Geiger counter are in progress. A method also was worked out to count automatically the coinciding deflections of two Geiger counters exposed to the same radiation. These methods were to be applied in the investigations of cosmic radiation.

Chemical Laboratory.—The chemical laboratory was engaged principally in inorganic analytical work. In particular the analytical characteristics of the rare elements (ruthenium, osmium, rhodium, iridium, palladium, platinum, gallium, germanium, selenium, tellurium, masurium, rhenium) were investigated in order to improve the methods for detecting and separating these elements from minerals and technical products.

In connection with these activities investigations were carried on concerning the relative quantitative distribution of all elements in the earth and in meteorites.

The work on the chemical and physical characteristics of the new elements rhenium and masurium was continued.

Research was started on the preparative separation of isotopic mixtures.

Analyses of chemical products and measurements on the constancy of glasses were conducted for industry.

Photographic Laboratory.—In the photochemical work the energy transformations of various photochemical reactions (for example, the carbon dioxide assimilation) were measured.

Further the Röntgen spectroscopy and arc spectroscopic investigations for the analysis of minerals and chemical products were carried out. Further attention was also given to the development of the term schemes for the *K*, *L*, and *M* series.

The effect of supersonic waves on chemical reactions was studied. Tests were made of photographic materials for industry.

Cryogenic Laboratory and Laboratory for Electrical Atomic Research.—In the cryogenic laboratory more than 14 cubic meters of liquid nitrogen, more than 1.5 cubic meters of liquid hydrogen, and more than 75 liters of liquid helium were prepared. The liqui-

fied gases were used, in part, in the cryogenic laboratory and partly in other laboratories of the Reichsanstalt. The liquid hydrogen was, in part, also given to other physical institutes.

The helium supply of the cryogenic laboratories amounts, at this time, to about 20 cubic meters, of which 10 cubic meters was obtained from America.

Contrivances were devised to draw off and to transport liquid helium from one place in the laboratory to another and there deliver it into the research apparatus without losing any helium.

The most important accomplishments of the cryogenic laboratory are the following:

Investigations on supraconductivity of metals, alloys, and combinations. The supraconductivity of titanium, thorium, columbium, copper sulphide, and of many carbides and nitrides were discovered.

Investigations on the contact resistance between nonsupraconductors and supraconductors. Measurements on the plasticity of metal crystals as low as 1.1° absolute. Investigations on the effect of a magnetic field on the resistance of single crystals of gold. In the electrical atomic research laboratory, investigation of researches on lithium atom rays for the accurate determination of its magnetic moment were so far advanced that the final measurements will soon follow. Further work was done on a sensitive method for measuring direct current, including development of a special galvanometer with a sensitivity independent of the frequency.

Laboratory for Fine Mechanics and Acoustics.—The arrangements for the testing of cylindrical and taper screw standards were further expanded. With the development of methods for measuring internal screw threads, the testing based on methods already devised at the National Bureau of Standards for taper ring gages was begun. The verification of existing and the construction of new tuning-fork standards were continued.

Principal Workshop.—In the laboratory there were constructed, among other things, an oil-pressure press for pressures up to $7,000 \text{ kg/cm}^2$, parts of a vacuum spectrograph, a current standard with variable plate interval, a variable current standard, a new construction of the contact for rotating spark gap, and various parts belonging to a screw thread measuring apparatus. A number of etalon rings and a thermostat of special construction were built.

Mass and Weight.—New ordinances, the mass and weight ordinance of May 30, 1908, as well as other proposed important regulations and notices have been gathered in book form under the title "Eichordnung of November 8, 1911, in the group of February 21, 1930, official edition," and have appeared in the press of the German National Lawbook for Commerce, Industry and Trade, Berlin W 9, Schelling Street, 12.

The contents of this book is a compilation of all national legal decisions which now control the weights and measures service of Germany.

Krypton tubes which serve for the absolute measurement of a 200 mm end measure were certified in larger numbers.

We can not agree to the proposal of Meggers, de Bruin, and Humphreys to substitute the strong yellow krypton line 5,871 for the weak yellow-green krypton line. The yellow krypton line 5,871 has two satellites of very low intensity lying close to the principal

line, while the yellow-green krypton line 5,650 shows no indication of fine structure, as already reported in the Report of Activities of the Physikalisch-Technischen Reichsanstalt for 1928.

In accordance with the recommendation of the International Committee of Weights and Measures in the year 1913, there were measured with highest possible accuracy four invar wires 24 m long (which had already been measured in Sevres and Teddington).

In agreement with the National Physical Laboratory, the Physikalisch-Technische Reichsanstalt, has established the precise measurements of English inch gages, which according to the relation found by the latest measurements by Sears, Johnson, and Jolly (Phil. Trans., Roy. Soc., A227, p. 281, 1928) yield the relation between the English and metric systems of measures, namely, 1 inch = 25.399956 mm.

The following accomplishments in the field of measuring instruments and measuring machines for length and for surface are to be noted:

Type tests of length and surface measuring apparatus; the definite admission of two types of construction of material measuring devices with numerical and chart printing mechanism.

Calculations and measurements on the magnitude of the possible thickness errors of the Sawyer leather-measuring machine.

The graphical representations of the hitherto defined permissible forms of construction of length and area-measuring machines, as well as preliminary work in the expansion of the testing service for accessory measuring tools and measuring machines for length and area.

Capacity Measures.—In the field of capacity measuring apparatus for liquids, many type tests, especially of measuring appliances for motor fuels (benzine and the like), have been carried on. The regulations have been expanded to keep pace with advancing needs.

The efforts of the metal industry to construct testworthy metal containers for lager beer and for pasteurizing of sweet beer and export beer in kegs under internal pressure have continued. A number of forms are being tried out.

The study of metal vessels in use in the brewing industry with respect to the change of volume in response to the needs has been extended to the first two permitted forms of barrels. There were also tested many sets of weights, scales, and grain testers for domestic and foreign trade.

Researches have been taken up to ascertain the effect of atmospheric humidity on the pouring quality of the grain in grain testing.

Instructions for the testing of scales have been modified in conformity with the development of the technique and the requirements of trade; in this connection many problems of test procedure have arisen as the result of the adoption of new ordinances. The decisions concerning the testing of scales were broadened and completed, in particular for wooden platform scales, for scales with tilting weight arrangement, for built-in scales with solid foundations, for railroad scales for continuous weighing, and for automatic scales. The type tests of scales with pendulum weights, counterpoise weight arrangement, and of automatic scales were continued. The standardization of scale construction was extended to the knife-edges of large scales.

Hydrometry and Chemical Measuring Apparatus.—Investigations were conducted for the establishment of the connection between density and percentage content of various glue solutions in the temperature range of 40° to 80°. The standardization of apparatus was further carried out in the organization of the German Associations for Chemical Apparatus.

Many type tests of gas meters of new construction were made and also of gas meters of high capacity.

The task was undertaken of assembling the special regulations for high capacity gas meters, and the special directions for testing and instruction.

Electricity and Magnetism.—On the basis of the conclusion of the International Committee on Weights and Measures to go over from the international units to the absolute units within a reasonable time, two of these units must be realized in the absolute system. Since at the Reichsanstalt only one conclusive determination, the absolute ohm, is yet available, the evaluation of a second unit (the absolute ampere) has been taken up.

The systematic investigation of the transformation phenomena in metals has been extended to semiconductors.

The work of setting up the new frequency scale has progressed. The possibility of using the transversal vibration of a piezo-electric light tube as a fixed point of the scale for the frequencies 1 to 20 kc was fully investigated. The natural frequencies were determined with an absolute accuracy of ± 5 millionths; they have remained constant within this accuracy of measurement during the year. The mean temperature coefficient between 0° and 20° C. amounted to about -9×10^{-6} at 1° C. For the frequency range of the scale from 30 to 600 kc longitudinally vibrating luminous resonators were developed. These are similar in construction to the transversally vibrating light tubes. Their frequency was in error by only 1 part in 5,000,000 and the temperature coefficient amounted to -2 to -3×10^{-6} at 0° C. The international frequency measurements were continued. They showed, using a transverse vibration light resonator of 10 kc as comparison standard, an agreement between the Reichsanstalt, the National Physical Laboratory, the National Bureau of Standards and the Electrotechnical Laboratory in Tokyo, of better than 1 part in 10,000,000.

A thermowattmeter for the measurement of small loads was thoroughly investigated and used for the measurement of the phase angle of very large capacities. To check the values attained several bridge methods were worked out.

Several new types of air condensers were built for the standard set of the Reichsanstalt, among which were three plate condensers of $0.1 \mu\text{f}$ capacity with air dielectric and quartz insulation. Despite the slight plate separation of about 1 mm, the time variations of this apparatus did not amount to more than 1 part in 10,000 as far as present experiments indicate.

Further, a suitable handy measuring bridge was developed for the measurement of very small capacities down to $0.01 \mu\text{f}$.

The compensation device for ionization measurement was further improved, in that the variable uranium oxide ionization standard was so arranged that its capacitance in every position remained the same.

For the purpose of standardizing dosage meters by means of weak Röntgen rays ("Grenzstrahlen" according to Bucky), a standard ionization chamber was constructed which has a standard value independent of the quality of the radiation from the hardest to the softest rays.

Jointly with the Sanitas Electrical Co., a Röntgen apparatus was developed which makes available the practical use of voltages up to 400 kv for the excitation of X rays of hitherto unattainable hardness.

The introduction of the protective regulations against radiation required the development of equipment of great sensitiveness in order to permit doses of 10^{-5} r/sec. which occur mostly outside of the protective screens.

An instrument developed for this purpose permits the measurement of the doses within 10^{-7} r/sec.

The measurements of ferromagnetic alloys with high initial permeability was continued. The conditions were investigated for the smallest possible dependence of the permeability on the field strength with weak magnetizing force and the corresponding technical processes given. For measuring the initial permeability of sheet-metal specimens, a differential arrangement was constructed, using as a test sample, a bundle of Epstein strips weighing 1 kg.

The influence of impurities on the weathering stability of dynamo and transformer steel was investigated and the favorable effect of limited copper additions was demonstrated, by which the corrosion resistance was notably raised without loss of the magnetic characteristics.

After suitable heat treatment, the nickel-manganese alloys of about 24 per cent manganese show about 15 per cent higher saturation value than pure nickel.

Data on a structural transformation was obtained, according to which the manganese atoms are distributed either statistically in the nickel lattice (paramagnetic condition) or are distributed according to the arrangement Ni_3Mn (ferromagnetic condition).

A new process was discovered for estimating the lubricating value of oils in the region of limiting lubrication with the aid of orientation effect. The orientation effect can be measured by the rectifier action during the passage of an alternating current through the bearing. The bearing then operates as a valve and rectifies a part of the alternating current.

A new process for the measurement of rapidly varying pressures was developed in which the pressure to be measured was transmitted to a piezo quartz crystal. The charges arising on the crystal were carried to an electrostatic tube voltmeter and traced by an oscillograph. The acceleration of a motor during starting, the cutting pressure on a slide lathe, the impact load on a steel wire, and the gas pressure of a high-speed internal-combustion engine can be measured and registered in this manner.

For the stroboscopic testing of revolution meters there was developed an electrically operated tuning fork with tube control, as well as an electromagnetically driven tuning fork with a finely adjustable mercury contact. The frequency of the forks amounted to

50 cycles per second and can, with the aid of a phonic wheel with counting mechanism, be determined accurately within ± 0.01 per cent.

Heat and Pressure.—A series of projects in the field of international cooperation were carried out, which related to the temperature scale (especially in the field of thermoelements), the physical characteristics of steam, and the comparison of viscosity measurements. The determination of the compressibility, as well as the thermal expansion and pressure coefficient of the thermometrically important gasses, has been completed and a new basis thereby attained for the correction of the gas thermometric measurements on the thermodynamic scale as well as for the absolute temperature of the ice point (273.16°K.).

Following Bonhoeffer and Hartek's discovery of para and ortho hydrogen, of which the boiling points differ by 0.1° , a method was worked out by which the two kinds of hydrogen at the temperature of their melting point can quickly be brought into thermodynamic equilibrium and by which the dependability of boiling hydrogen as a thermometric fixed point will be assured. The investigation was also extended to the boiling point of nitrogen.

Resistance thermometers with thick platinum wire have been found available for use up to the melting point of gold, and excel the thermoelement in accuracy. The quadratic formula relating resistance and temperature will be altered only by a small additional term of a higher order.

An objective method for the optical measurement of temperature by the application of the photo-electric cell is being worked out.

A pyrometric determination of the melting point of chromium using an electrically heated slab gives a value of $1,765 \pm 10^\circ$. The slab was provided with a hole which radiated as a black body.

To determine the heat radiation of carbon dioxide the absorption band of this gas at 2.7 was studied in the range of 20° to 900° .

It has been found possible to establish the molecular volume of chemical compounds at low temperatures from the course of the closed transformation of the specific heat of solid methane, also by the inconstancy of the thermal expansion at about 20.3° .

The new concept of the contribution of vibrational energy of polyatomic molecules to the specific heat of a gas consisting of these molecules necessitated a new calculation of the earlier data obtained at the Reichsanstalt in the temperature range of 20° to $1,350^\circ$ on the specific heat of nitrogen, oxygen, carbondioxide, and water vapor. The result showed a satisfactory agreement between observation and theory.

The research on the heat of vaporization of water was carried to higher temperatures. At 310°C. it gave 315.9 cal./g.

The heat transfer with condensation of steam flowing through pipes was further investigated. Under the same experimental conditions, it was found that with rapid condensation the superheated steam in the axis of the pipe was cooled less than if the condensation was slow. The reason was ascertained to be that the steam whirls which formed during rapid condensation streamed back less in the middle of the tube than with slower condensation.

The arrangements for the measurement of higher pressures were completed, as well as those for the investigation of vacuum pumps and for determining the humidity of air.

During the year 1929 there were tested 503,710 clinical thermometers, 6,551 expansion thermometers, 393 items for electrical and optical temperature measurement, 415 devices for pressure measurement, 426 pieces for oil investigations, and 125 miscellaneous articles.

Optics.—Plates of glass or quartz half-silvered on both faces were successfully combined with each other for the excitation of sharp interference.

Measuring apparatus devised for navigation with infra-red radiation (fog navigation for ships and aircraft) proved to have a high directional sharpness and a high degree of independence of outside influences. Through transverse combination of two arrangements, both azimuth and altitude directions were obtained at the same time. Also an optical signalling system for railways was successfully developed using infra-red radiation.

A new interference apparatus was constructed for the quantitative measurement of strains in glass. This has proved very dependable and by means of a simple observation of Haidinger rings in reflected polarized light the existing tension can be expressed numerically in terms of the magnitude of the double refraction.

The present universally used 100 point of the saccharimeter is defined through the standard quartz plate which rotates spectral pure sodium light (made by volatilizing a stick of cast soda in a Linneman illuminating gas-oxygen blowpipe, without the loss of drops of soda dropping off) about 34.657 angular degrees at 20° C. In order to get rid of the expensive quartz wedge compensation and also to reduce appreciably the setting and reading errors, the new Pirani sodium arc lamp in vacuum has been successfully introduced into saccharimetry. The lamp burns at 1.3 amperes with extreme brightness while the optical center of gravity does not change appreciably with time. A circle reading instrument illuminated with this light, spectrally purified, on the basis of the measurements conducted here between the zero and the 100 point must read 34.664 angular degrees if the sugar solution in this apparatus shall give the same sugar value as in the saccharimeter with quartz wedge compensation for white light. As would be expected, the quartz plates of 100 sugar degrees ought to indicate only 99.970 sugar degrees with the circle apparatus as so defined (with the new sodium lamp) at 20°.

A new color mixing apparatus of very high precision has been constructed. By means of a trichromatic setting, the position of a color in the Helmholtz-Young triangle can be found by a single measurement.

A method of investigating the vibrations of diaphragms was worked out especially for those used in loud speakers. Vibrations excited in the acoustic medium of a tone-transmitter were made visible by a diaphragm provided with a mirror, of frequency n by means of a high-voltage alternating current of frequency $n \pm \Delta n$, (in which Δn is very small compared to n) in a glow tube of a special form. Light reflections are developed which afford characteristic paths of motion to the observer for the state of vibration and the

characteristic frequency of the diaphragm. From the observed turning of angle of the surface element and the geometrical position one can construct an expressive model picture of the vibrating diaphragm at any desired point of time. This method may be used to investigate any vibrating surface of mechanically excited bodies, in case there are angle turnings present in the surface element of at least 30 seconds of arc.

LABORATOIRE NATIONAL D'ESSAIS MÉCANIQUES, PHYSIQUES, CHIMIQUES, ET MACHINES

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

The Laboratoire d'Essais (National Testing Laboratory) is installed in the Conservatoire National des Arts et Métiers (National Conservatory of Arts and Crafts) and is attached to the Ministry of Public Instruction and of Fine Arts (Undersecretary of State of Technical Education).

A technical committee of 23 members controls its operations. The director is J. F. Cellerier.

This is the national testing laboratory of France for various materials and machines. It comprises at this time a personnel of 188 members. The activities are divided into six departments: Physics, verification of measuring instruments, metals, materials, machines, and chemistry.

From October 1, 1928, to September 30, 1930, there were 3,609 requests for tests, namely:

| | |
|--|--------|
| Physics..... | 548 |
| Verification of measuring instruments..... | 152 |
| Metals..... | 945 |
| Materials..... | 718 |
| Machines..... | 131 |
| Chemistry..... | 1, 115 |
| Total..... | 3, 609 |

Physical Tests.—New apparatus for determining coefficients of thermal conductivity of heat-conducting materials have been established. They are provided with electrical heating pads placed between two identical samples to be verified. The regulation of the apparatus is easy.

Comparative tests have been made of the transmission of sound by partitions made up of materials intended for building construction. A novel apparatus has been constructed permitting the suppression of interior echoes. The experiments are to be conducted in cooperation with the important group, the "Touring Club of France."

The scientific study of art paintings has been continued. The processes previously employed (X rays, ultra-violet, various luminous radiations, spectrography, and so on) have been further developed. New studies have been undertaken pending the definite installation of a laboratory of scientific research at the Louvre Museum, the direction of which has been entrusted to J. F. Cellerier.

Verification of Measuring Instruments.—This department has made verifications of measuring apparatus, such as thermometers, alcoholometers, hydrometers, boiling-point apparatus, measuring glassware, etc.

The legal verification of clinical thermometers was an important accomplishment. The number of these latter instruments controlled by the laboratory tests, from January 1 to October 1, 1930, was 870,000, of which the great majority are of French manufacture.

On demand of the Syndicate of Vinegar Producers of France, the testing laboratory has undertaken a study relative to the definition of the acidimetric "degree" of vinegar and to the procedure to be followed in the determination of this degree. The technical researches corresponding to this study have been divided into two parts:

1. Chemical study relative to the standard test liquids utilized in the study of vinegars and to the control of these liquids; this part has been intrusted to the service of chemical tests.

2. Metrological study relative to the apparatus to be used in utilizing these standard test liquids and to their control. This part has been intrusted to the service of verification of measuring instruments.

Tests of Metals.—The very numerous requests for tests have not permitted devoting any considerable time to research. We may, however, mention:

The study of the friction of lubricating materials and of metals under great pressures at high or low temperature and high velocity. A special machine has been set up for the purpose.

The photomicrography with polarized light utilized for minerals and ferrous products has been extended to the examination of microchemical reactions upon pigments; with the aid of special screens it has been possible to identify and determine the color of certain colored pigments.

Studies of the hardness to rebound have been undertaken on the teeth of yarn combs.

We may likewise mention that with the aid of a series of special devices we are obtaining, in macrography and micrography, a continuous gamut of magnifications from one-fifth to more than 1,000 diameters.

We may also point out that special arrangements permit illumination of objects to be studied under all incidences from normal incidence up to grazing incidence.

Tests of Structural Materials.—New apparatus have been used for test, notably amplifying, registering apparatus permitting the recording of the study of deflections obtained in tests of beams and of boards; and a penetrometer with arrangement for electromagnetic control for the study of the penetration of bitumen, tars, and asphalts. For the study of paint, intended for construction, an apparatus has been constructed by the laboratory for wear with a sand jet under low but fairly constant pressure.

Particular studies have been made concerning the resistance to rupture of different types of terra-cotta hollow slabs, and the waterproofing of mortars and concrete by the use of certain water-resistant products and by the addition of diatomaceous earths.

Finally, an interesting study has been begun having for its object research on the best means of avoiding the destruction of the stone of historical monumental structures. This study consists of a series of special tests of various products and of investigating the protective coatings for calcareous and granite stones.

Tests of Machines.—Work has been carried on concerning the study of output of boilers for heating under different conditions, on the acceptance of installation of central heating in homes, schools, etc., as well as the characteristics of radiators functioning with hot water or with steam. There is to be noted, particularly, the very interesting study on a new process of boiler heating with the aid of automatic burners permitting the utilization of mazout.

A new study is nearly ended on methods of testing pneumatic hammers. This will be the object of an early bulletin of the laboratory. Besides, tests have been made of all kinds on thermal motors, vaporizers, and carbureters, regulators, compressors, joints for steam piping at high pressure, and smoke consumers.

Chemical Tests.—As usual every year, products of all kinds involving metals and alloys, structural materials, lubricants, combustible solids and liquid fuels, paints, rubber, and organic materials, have been analyzed.

There is to be noted a certain number of projects on corrosion, degalvanizing, antifreeze products, various cleaning products, and products destined to improve the combustion of combustibles and motor fuels, etc.

As stated in the section on "verification of measuring instruments," an important chemical study has been undertaken apropos of the definition of the acidimetric "degree" of vinegar and of the procedure to be followed in its determination.

Standards.—The studies affecting standards have been considerably developed in France during late years, and this branch of national activity has itself also been reorganized.

At the Ministry of Commerce has been created the Higher Committee of Standardization which is none other than the old Permanent Commission of Standardization enlarged by the addition of large new groups.

The standards are elaborated and studied technically by the various bureaus of standardization which are either private organizations (Committee on Mechanical Standardization, Committee on Foundries, Union of Electrical Syndicates, Bureau of Standardization of Automobiles, etc.), or State organizations constituted in the Ministerial departments (air, war, navy, public works, etc.).

The Laboratoire National d'Essais (National Testing Laboratory) has collaborated in various technical activities of standardization of various metals and materials, solid and liquid motor fuels and of various parts of machines.

LABORATOIRE CENTRAL D'ÉLECTRICITÉ

(Paris, France)

The laboratory has executed a series of measurements on aluminum conductors of French make, the results being intended for use by the International Electrotechnical Commission in fixing the characteristics of standard aluminum. Likewise it has conducted researches to determine permissible current densities in aluminum conductors of various cross sections.

The researches related to the determination of electrical units in absolute measure, in particular the determination of the absolute value of the ohm, have been under way. A mutual-inductance

standard designed to serve as a point of departure for these measurements has been produced; at the same time progress has been continued in the measurements required for this determination.

In the course of the year 1930 the laboratory has had occasion to compare its resistance standards with those of the Physikalisch-Technische Reichsanstalt and of the Central Chamber of Weights and Measures of the Union of Socialistic Soviet Republics.

A new form of incandescent lamp intended to serve as a standard of luminous intensity has been studied, and the standards of luminous flux of the laboratory have been compared with those of the Physikalisch-Technische Reichsanstalt.

For the study of the transmission factor of colored filters intended to solve the problem of heterochromatic photometry which arises on the passage from primary standards of luminous intensity with carbon filaments to the secondary tungsten-filament standards, a procedure based upon the use of photo-electric cells has been developed.

Finally the laboratory has continued its collaboration with French physicists who seek to realize a luminous standard based upon the properties of a black body.

Among the projects contemplated for the end of 1930 and for 1931, the following may be mentioned:

The completion of a new inductance standard.

The continuation of researches relative to the determination of the ohm in absolute value.

A new determination of the electromotive force of standard cadmium cells in terms of the silver voltameter, conformably to the decisions of the advisory committee on electrical units.

New comparisons of standards of luminous flux with those of foreign laboratories, for the purpose of eliminating certain divergencies which have appeared in the previous comparisons.

NATIONAL STANDARDIZING BODIES

Brief outlines of the activities and accomplishments of the national standardizing committees or associations in 21 countries in which such organizations are now functioning are given below, in alphabetical order, with the exception of those of the American Standards Association, which are presented in Chapter VII.

The order of organization of the national bodies is as follows: Great Britain, 1901; Holland, 1916; Germany, 1917; United States of America, 1918; Switzerland, 1918; France, 1918 (reorganized in 1928); Belgium, 1919; Canada, 1919; Austria, 1920; Italy, 1921; 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.

The method of cooperation developed by the British is followed, with more or less modification, by all of the national bodies. Technical decisions involved in the formulation of standards are rendered by so-called sectional committees made up primarily of accredited representatives of the various groups interested therein.

Through the interchange of information arranged in regular form on uniform blanks, all of the national bodies are kept posted as to the new projects, drafts of standards, and general tendencies in the

national standardization work in all other countries. All approved standards are interchanged as a matter of routine, and each national standardizing body acts as a sales agent for the approved standards of the other bodies. The sketches given below are based chiefly on information supplied by the foreign national bodies to the American Standards Association and on material furnished by the foreign offices of the United States Bureau of Foreign and Domestic Commerce.

An international federation commonly known as the International Standards Association has recently been formed to serve as a connecting link between several of the national bodies dealt with in this section. A more complete treatment of this organization is given in Chapter II, page 70.

Australia.—Standards Association of Australia, W. R. Hebblewhite, general secretary, Macleay House, 16 College Street, Sydney, New South Wales, Australia.

The Standards Association of Australia was established as a consequence of the appointment in Great Britain of a Central Committee on Standardization and Simplification and the initiation of a project to secure unification of standards throughout the Empire and the development of simplification on an Empire basis. It was felt that a more effective support could be given to this movement by co-ordination of the existing standardizing bodies, and hence, in July, 1929, the Australian Commonwealth Engineering Standards Association (founded 1922) and the Australian Commonwealth Association of Simplified Practice (founded 1927) were amalgamated to form the Standards Association of Australia.

The Standards Association is the body officially recognized as the authority for promulgating national standards in Australia, and receives the indorsement of the Commonwealth and State Governments and their departments, and of professional, industrial, trade and commercial organizations. The association has complete autonomy, but in order that the Commonwealth Government may be kept informed of the association's progress and its requirements and may thus be enabled the more effectively to render assistance, a liaison has been provided through the Council for Scientific and Industrial Research which is under the ministerial control of the vice president of the executive council of the Commonwealth Government.

The association is governed by a council comprising representatives appointed by the governments of the Commonwealth and each State; 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; and the Federal and State purchasing departments.

The technical work of the association is directed by two divisions, standards and simplified practice, and by a special committee for power survey, which is engaged in a survey of the power resources of the Commonwealth and their development and coordination.

In the standards division, specifications are drafted by sectional committees of the usual representative character. At present 33 sectional committees are operating, which with more than 300 subcommittees and panels, have a personnel of 2,600. In order to secure suitable collaboration in the preparation of specifications that are of general interest to two or more sectional committees, each of the committees concerned appoints representatives to a coordinating committee, whose decisions are, however, referred back to the parent sectional committees for indorsement. Specifications, when drafted, are printed and circulated widely in proof form for public comment prior to final review and publication. In preparing standard specifications, the national and institutional standards of other countries are studied in order that no unnecessary departure shall be made from the best current practice. In particular, it is the policy of the association to follow British standard practice as closely as local conditions and requirements will allow without detriment.

The simplified practice division does not as a rule appoint permanent committees. After a careful staff investigation of any project, and compilation of statistical data as to relative production and sales numbers, a report on the position is placed before a representative conference and a draft recommendation approved. This is then reviewed by similar conferences in other States of the Commonwealth. The final stage in the drafting is the coordination of State views for the issue of a recommendation representing the consensus of opinion throughout the Commonwealth. Before final adoption a recommendation must receive the indorsement of 80 per cent of suppliers by volume of trade.

The association's revenue is contributed for the most part by the Federal Government, while State and local governments assist to a lesser degree. Organizations and firms, besides contributing the services of their officers in committee work, enroll as subscribing members, of which there are about 350. The rate of subscription is voluntary, subject to a minimum annual fee. Technical societies and universities give every possible support, in some instances appointing their own committees to collaborate with those of the association.

The association has published 135 approved specifications and reports, while 30 projects have been circulated for general criticism. Of these, about 60 deal with the electrical industry, 40 with the paint and varnish industry, and 30 with railway permanent way and rolling stock. Others relate to iron and steel, cement and concrete, pipes and fittings, plumbing accessories, machine parts and accessories, and chemical industry.

In the section on safety codes, work is going forward on codes for safeguarding human life and property, and for design and erection, among which are regulations dealing with concrete, reinforced concrete, and steel frame structures, elevator (lift) installations, cranes and hoists, boilers and unfired pressure vessels, and electrical wiring. Of these, the last two are of particular importance.

The boiler code has been prepared during the past two years with the assistance of a great number of departmental officers and private experts, in order to remedy the disabilities attending the use of uncoordinated and somewhat inadequate regulations in force in the

respective States of the Commonwealth. The code will be a comprehensive compilation dealing thoroughly with boiler and unfired pressure vessel design, erection, maintenance, and inspection.

The electrical wiring rules in general use in Australia were framed by the Institution of Engineers, Australia. Recently, at the request of the institution, the association undertook the revision, extension, and subsequent direction of the rules. A draft of the new rules is now about to be issued and will be influenced by the results of recent investigation and by modern developments in the electrical industry.

No simplified practice recommendations have yet been published, but good progress has been made with a number of projects, many of which indicate striking possibilities of reduction in diversification. A survey showed that 150 different varieties of galvanized iron ridging, guttering, and down piping could be reduced by 70 per cent. One hundred and twenty sizes of plywood panels for doors have been reduced by 60 per cent. Banking and allied interests are working on the simplification of bank checks and other documents. Other subjects under consideration are road gully gratings, shovels, laminated steel springs for automobiles, wire netting, high-pressure water fittings, brass plumbing and sewerage fittings, and building material classification.

The Power Survey Committee has issued a report on the coal resources of Australia, which deals comprehensively with the geological and geographical distribution of the various coalfields, the chemical and physical characters of the different coals, and the suitability of such coals for various purposes and industries. A report on power alcohol treats the subject from the point of view of a potential source of power in the Commonwealth. A further report describes progress in the development of combustion of Victorian brown coal.

In international activities the association is represented by its Power Survey Committee, which is, by Government authority, the Australian National Committee for the World Power Conference, and by its Electrical Committee, which is the Australian Committee of the International Electrotechnical Commission. These two committees are actively participating in their respective international movements.

Austria.—Österreichischer Normenausschuss für Industrie und Gewerbe (ÖNIG), Dr. Jaro Tomaides, secretary, Vienna, III. Lothringerstrasse 12, Austria.

The Austrian Standards Committee was established in September, 1920, by the National Society for Austrian Industry, with the co-operation of the Austrian Union of German Engineers (ÖVDI). Together with the Committee for Economic Management (AWB), and the Society for Heat Economy (GW), the ÖNIG now constitutes the technical division of the National Society for Austrian Industry; moreover, these three organizations (the ÖNIG, the AWB, and the GW) have operated since 1928 as branches of the Austrian Committee for Economy (ÖKW).

The ÖNIG is the central Austrian standardizing organization, and strives for the standardization of industrial products and production

along the following lines: Adoption of German industrial standards already existent or in preparation, with any necessary modifications, through fundamental recognition of their adaptability to the needs of Austrian standardization; setting up of Austrian national and branch standards by consideration and revision of existing standards and by the formulation of additional standard proposals; and co-operation with the standards committees of other countries.

Since its foundation, the ÖNIG has developed an extensive organization, which now includes divisions for general standards, building practice, mining and smelting practice, chemical industry, electrotechnics, fire fighting, hospital practice, agriculture, mechanical engineering, and commercial practice.

The work of preparing Austrian standards is begun, on evidence of satisfactory general interest, by committees representative of producers, distributors, consumers, scientists, and Government departments. For the sake of securing adequate criticism, proposals are published for a suitable period in the magazines, "Sparwirtschaft" and "Elektrotechnik und Maschinenbau," as well as in other technical periodicals.

In the event that criticism is made of a proposal, it is returned to the committee for revision, until complete agreement is established. Finally, the proposal is sent to an editorial committee, where it is criticised for form and style, as well as for agreement with other standards, and then to the executive committee for final examination and approval, after which it is published as an Austrian standard (ÖNORM).

The ÖNIG has taken an active part in the work of the International Standards Association, having been made a member of the technical committees for metric screws and threads, tolerances, paper forms, rivets, pressure testing for stationary steam boilers, pipes for canalizations, iron and steel, agricultural machinery, and sieves. Further, the ÖNIG has been given the secretariat of the technical committee for formulating rules for the construction of sprinkler systems, and has been intrusted with the preparation of the report on the international standardization of wood screws.

The committee has published 434 standards, while 309 projects are under way. Of the latter, 105 have been published for criticism. The following table shows the status of work in the nine industrial groups.

| Industrial groups | | Completed standards | Published for criticism | Work under way | Total |
|-------------------|-----------------------------|---------------------|-------------------------|----------------|-------|
| A. | General standards..... | 4 | 7 | 31 | 42 |
| B. | Building..... | 62 | 41 | 24 | 127 |
| BH. | Mining and smelting..... | 40 | ----- | ----- | 40 |
| C. | Chemical industry..... | 15 | 14 | 7 | 36 |
| E. | Electrical engineering..... | 54 | 5 | 56 | 115 |
| F. | Fire fighting..... | ----- | 1 | 6 | 7 |
| K. | Hospitals..... | ----- | ----- | 11 | 11 |
| L. | Agriculture..... | ----- | 2 | 8 | 10 |
| M. | Mechanical engineering..... | 230 | 32 | 36 | 298 |
| V. | Traffic..... | 29 | 3 | 25 | 57 |
| Total..... | | 434 | 105 | 204 | 743 |

The following projects are under way in the various technical committees: Standards for technical organization; mechanical testing of materials; business forms; office furniture and appliances; kitchen utensils; building regulations (regulations for the performance of building work, also for steel buildings, hoists, etc.); building materials (tiles, clinker plates, stove tile, sand, etc.); street paving materials; fittings for doors and windows; canalization subjects; mining tools; water analysis; glue; rosin; oils and fats; dry paints; tar; lime; electrical conducting materials; crane motors; chemicals for fire extinguishers; hospital beds; surgical instruments; nursing apparatus; parts for agricultural machines; screws; steels; elements of steam-boiler firing; gas meters; air travel; traffic; wheels; hose valves; construction parts.

Belgium.—Association Belge de Standardisation (ABS), Gustave L. Gérard, general secretary; Max Reichert, secretary, 33 rue Ducale, Brussels, Belgium.

The report of the Belgian Standards Association, as of July, 1930, shows the completion of 47 standards, with work progressing on 17 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 | 2 |
| B. Mechanical engineering..... | 20 | 6 |
| C. Electrical engineering (Belgian Electrotechnical Commission)..... | 16 | 1 |
| H. Metallurgy..... | 1 | 1 |
| K. Chemical industry..... | 0 | 2 |
| M. Mining..... | 0 | 2 |
| P. Paper industry..... | 1 | 0 |
| Z. Miscellaneous..... | 0 | |
| Total..... | 47 | 17 |

Completed standards cover such subjects as metallic construction; galvanized-iron roofs and walls; bridges; electric motors and transformers; wire rope; transformer oil; impregnated paper cables; reinforced concrete; rubber-covered wires and cables; paper sizes; zinc ores; copper rivets; cast-iron pipe; aggregates; insulators; telegraph poles; machine screws; structural steel; electric-cable terminals; electrotechnical symbols; lamp sockets; tolerances; gages; insulated conduits; incandescent lamps; cements; and small electrical apparatus.

The latest standard to be published, Report No. 29-1930, deals with profiles. Studies carried on since 1919 led, in the latter part of 1928, to the adoption of four series of shapes of beams, of U-sections of equal and of unequal angles. Because of the length of time necessary for the calculation of characteristics, the report includes, at present, preliminary tables which contain only the principal dimensions and weights of the shapes definitely adopted by the association, but which already permit the adoption of simplified practices by producers and consumers. The report in its final form will include

elaborations of the present tables, and further tables covering T-sections.

The association has published, for general comment and criticism, a project on the chemical testing of oils. The project contains test methods for the determination of the content of saponifiable matter, the index of acidity, the asphalt content, and the ash content. Although the need for an aging test has been felt, such a test was not included in the project, because there is at present no method generally accepted in Belgian laboratories.

Canada.—Canadian Engineering Standards Association (CESA), B. Stuart McKenzie, M.E.I.C., secretary, 46 Elgin Street, Ottawa, Canada.

The organization of the Canadian Engineering Standards Association is patterned after that of the British Engineering Standards Association. Work is carried on under the direction of a main committee, composed of representatives of technical, educational, and industrial bodies. Under this committee are seven sectional committees, covering various branches of engineering. Working committees, under the supervision of the sectional committees, perform the work of actually preparing reports on projects. Membership of these committees is composed of representatives of producing and consuming interests, as well as of technical advisers. The association's policy of dealing directly with business firms or organizations, and not through sponsor bodies, helps to establish cordial and intimate relations with industry, and saves time in the completion of the various projects.

The association has completed 32 standards, while work is going forward on 25 other standardization projects, as shown in the table.

| Industrial groups | Standardization projects | |
|--------------------------------|--------------------------|-----------|
| | Total | Completed |
| A. Civil engineering..... | 18 | 7 |
| B. Mechanical engineering..... | 12 | 4 |
| C. Electrical engineering..... | 14 | 10 |
| D. Automotive work..... | 3 | 2 |
| E. Railway work..... | 1 | 1 |
| G. Ferrous metallurgy..... | 8 | 8 |
| M. Mining machinery..... | 1 | |
| Total..... | 57 | 32 |

The 1930 revision of Part I of the Canadian Electrical Code has been issued. This code agrees rather closely with the National Electrical Code in use in the United States, and also conforms in part with the National Electrical Safety Code. Other material includes a section on maintenance and operation, instruction for resuscitation from electrical shock, a table for lead-covered communication cables, and a cross-reference list showing changes from the previous edition.

Among other recently-issued publications are standards for transformers, steel structures, and steel bars and billets. Standard No. C2-1929, for single-phase distribution transformers, applies to 25 to 60 cycle oil-filled transformers up to and including 200 kv-a at

or below 15,000 volts, and does not cover auto, testing, dry type, or other special transformers. The standard is subdivided into sections on classification, taps, operation, ratio, rated capacities, polarity, tests, leads, cases, standard accessories, and markings.

Four standards for commercial-quality steel bars and billets, Nos. G24-1929, G25-1929, G26-1929, and G27-1929, deal, respectively, with standard methods of sampling for the analysis of steel billets, bars, and shapes; carbon-steel billets and bars of forging quality; hot-rolled bar steels; and cold-finished bar steels and cold-finished shafting.

A revision of the specification for steel structures for buildings has been issued as standard No. A16-1930. Certain radical changes have been made in the new edition, chief among them being the increase of the allowable unit stress for axial tension from 16,000 to 18,000 pounds per square inch, with a corresponding increase in other unit stresses; revisions of the column formula and the allowable unit stresses for bending, shearing, and bearing; and changes in the recommended live loads for snow load on roofs and for wind load.

For some time the Canadian Engineering Standards Association has been negotiating with the Canadian National Committee of the International Electrotechnical Commission with a view to establishing closer relations. It is hoped that the Canadian National Committee, previously under control of the Engineering Institute of Canada, can be transferred to the sponsorship of the CESA. This should prevent much overlapping in the work of electrical standardization.

Czechoslovakia.—Československá Normalizační Společnost (ČSN), B. Rosenbaum, director, Dum Cs. Inženýru, Prague I, Czechoslovakia.

About 57 standards, printed both in Czech and in German, have been published by the Czechoslovakian Standards Association, according to its May, 1930, report. Work is going forward on various projects.

Completed standards cover the subjects of threads, screws, nuts, and washers; wrench openings; rivets; keys and springs; angle irons; tees and zees; cotter pins; machine tool couplings; preferred numbers; steam-boiler testing; tongues and grooves for planed lumber; car wheels and trucks; steel sections; transmission; rolled and forged carbon steel; color shades of enamel; soft and hard solders; rules for acceptance testing of cooling plants; tables and diagrams for refrigerants; rules for testing water turbines; tanned leather belting; elevators; bolts and nuts; steel rails; steel castings; hand wheels and grips; chains; copper sheets; mechanical drawings; testing of steel; pipe systems; cast-iron pipe, and traps for gas and water conduits; steel pipe; form of specification for construction; iron and timber structures in tall buildings; copper, brass, and aluminum sections, wire, and plates; rules for carpentry; tolerances; grey-iron castings; rules for pressure vessels and steam boilers; flanges; mechanical couplings; central heating and ventilation; gas installations; xyolite; copper; brass forms; paving stone; water power; and clay sewer pipe.

Czechoslovakian manufacturers of wooden flooring have agreed to open a central rationalization office to standardize the measurements for wooden flooring, and the quality of raw materials. An executive committee has been appointed, and measures have been taken to insure that work will begin in the near future.

At a national standardization conference convened in Prague by the Czechoslovak National Committee for Scientific Management, the field of work was expanded to include hand tools and machine tools, porcelain, and timber for sawing. Intensified standardization in the building industry was agreed upon. It was requested that uniform principles of accountancy, covering cost accounting, sales, and purchases, should be worked out for typical industrial undertakings.

The necessity of centralizing all standardization work in the Czechoslovakian Standards Association was unanimously recognized, and it was recommended that corporations which had hitherto studied standardization work outside the standards association should effect closer cooperation with that body to prevent unnecessary division of forces.

Recommendations were adopted concerning the general use of Czech standards by Government departments, autonomous bodies, and corporations, universal adoption of standard paper sizes, Government support of the standards association, and the intensified spreading of standardization propaganda.

Denmark.—Dansk Standardiseringsraad (DS), H. E. Glahn, secretary, Industribygningen, Copenhagen B, Denmark.

The Danish standardizing body, which recently received the new designation, "Danish Standards Council," represents an affiliation of those technical, industrial, and trade organizations which are interested in standardization, together with the various Government departments. Its 24 members are appointed by the Ministry for Industry. About one-half of the expenses of the council are borne by the Government.

The work of the council is carried on by a business committee and 13 technical committees, whose members serve without compensation. The personnel of these technical committees and their 22 subcommittees numbers 159. The work covers the following subjects: 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; and land rollers.

The business committee is empowered to make decisions on behalf of the council, except as regards acceptance of standards, membership of the council, yearly budget and program, and approval of the annual report. Among other duties, the business committee collects information regarding standardization activities at home and abroad, and corresponds with foreign standards bodies; determines the origin of proposed standards, their influence on other standards, and if they have been properly submitted for comment and criticism by interested parties; and investigates the degree of correlation between the proposals under consideration and similar foreign standards.

At its two meetings in 1929, the council accepted, as Danish standards, 15 proposals for standard cones; standard roundings; metric screw threads, 1 to 10 mm; trapez threads, 10 to 300 mm; slotted screw-heads, 6 to 36 mm; gas cocks for kitchens; and technical drawings (projection methods, thicknesses and sorts of lines, infraction lines, indication of cutting planes, and standard lettering). Thirty-one proposals were accepted as temporary Danish standards—2 for width across flats (nominal sizes and width across corners) and 29 for limits and fits for diameters. The report as of July 1, 1930, shows a total of 66 accepted standards, with 91 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..... | 49 | 24 |
| B. Mechanical engineering..... | 12 | 12 |
| C. Electrical engineering..... | | 2 |
| G. Civil engineering..... | 3 | 3 |
| H. Ferrous metallurgy..... | | 40 |
| L. Textile industry..... | | 4 |
| N. Agriculture..... | | 3 |
| P. Paper industry..... | | 1 |
| Z. Miscellaneous..... | 2 | 2 |
| Total..... | 66 | 91 |

Projects under way include: Symbols for drawings (architective, mechanical, and electrotechnical drawings, and drawings for sanitary installations, railways and streets, building materials, and reinforced concrete); tolerances for width across flats; hexagonal and castle nuts; bright, semibright, and rough round washers; square and hexagonal bolt heads; keys and shafts; gas-meter screws; steel and iron; textiles for hospitals; rings for rollers; plows; paper sizes; and furniture and chattels for hospitals.

The Danish Standards Council has adopted the symbol, DS, as a mark which may be used on manufacturers to show that they conform to the requirements of Danish standards. The right to use the symbol is given free upon application, with the provisos that the product be manufactured in Denmark, and that it actually conform to the requirements of the standard concerned. Penalties are attached to the misuse of the symbol.

Finland.—Finlands Standardiseringskommission (SFS), A. Willberg, secretary, Mikaelsgatan 18, Helsingfors, Finland.

The Finnish Standards Committee was founded in June, 1924, beginning its work in October of that year. It is composed of representatives of the departments of national defense, commerce and industry, and agriculture, the Government railroads, the board of directors for public buildings, the national association of wood utilization, the national agricultural products association, the national industrial products association, technical societies, and the national university. About two-thirds of the expenses of the committee are defrayed by the Government, and the remainder by interested private organizations.

According to the report for October 15, 1930, the committee has approved 217 standards which are now in use in Finland. Work is going forward on 500 projects. The table classifies the standards and projects according to the various industrial groups.

| Industrial groups | Standards | Projects |
|--------------------------------|-----------|----------|
| A. General standards..... | | 25 |
| B. Mechanical engineering..... | 177 | 250 |
| C. Electrical engineering..... | 1 | 100 |
| H. Raw materials..... | | 50 |
| K. Chemistry..... | | 5 |
| N. Agriculture..... | | 20 |
| P. Paper..... | 9 | 20 |
| Z. Miscellaneous..... | 30 | 30 |
| Total..... | 217 | 500 |

The board of directors of the Association of Finnish Architects is considering a plan for the standardization of smooth-surface plywood doors. Under the plan, these doors would be standardized at widths of 500, 600, 700, 800, 900, and 1,000 mm., and at a height of either 2,050 or 2,100 mm. Such standardization, it is believed, not only would facilitate the work of Finnish architects, but would also reduce production costs at plywood factories to an extent that would enable them to produce quantities at a competitive price for export.

France.—Association Française de Normalisation (AFNOR), R. Girardeau, director general, 27 Avenue de Friedland, Paris, France. The French Standards Association was created in 1926 by the representatives of various industries, to encourage French economic expansion and develop the domestic market by the simplification of machines and manufactures. Although it is granted a Government subsidy, it is a private organization, and receives most of its income from its membership subscriptions.

The association 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 approval to completed standards.

The technical work of standardization projects is conducted by standardization associations, or, in industries where such associations do not exist, by competent committees appointed by the AFNOR.

Among the subjects for which committees are now operating, are: Hydraulic presses, iron and steel products, liquid measures, stationary boilers, naval construction, steel shapes, preserve cans, roofing sizes, drawn-wire products, ballast forks, and hand-tool products.

The status of projects and completed standards, as of July 1, 1930, is as shown in the table below. Included are the standards of the mechanical, electrical, and automotive standardization bureaus, which have been submitted to the Higher Committee on Standardization for its official approval, and the projects of the Bureau of Standardization of the Air Ministry.

| | Completed standards | Work in progress | Revisions in progress | Total |
|---|---------------------|------------------|-----------------------|-------|
| A. Metallurgical products..... | 8 | 3 | 8 | 19 |
| B. Construction materials..... | 9 | 0 | 2 | 11 |
| C. Electrical industry..... | 18 | 0 | 0 | 18 |
| International Electrotechnical Commission..... | 0 | 2 | 0 | 2 |
| French Electrotechnical Committee and Union of Electrical Syndicates..... | 15 | 0 | 0 | 15 |
| E. Machine elements..... | 0 | 0 | 12 | 12 |
| Committee on Standardization of Mechanics..... | 70 | 27 | 1 | 98 |
| F. Metallurgy and metallic construction..... | 2 | 0 | 3 | 5 |
| H. Thermal machines and hydraulics..... | 1 | 0 | 0 | 1 |
| J. Naval construction..... | 0 | 0 | 14 | 14 |
| K. Mining industry..... | 0 | 1 | 0 | 1 |
| L. Cycles and automobiles (Bureau of Automobile Standardization)..... | 66 | 29 | 0 | 95 |
| M. Units of measure and tolerances..... | 0 | 2 | 0 | 2 |
| O. Aeronautics (Bureau of Standardization of the Air Ministry)..... | 0 | 37 | 0 | 37 |
| P. Construction..... | 0 | 0 | 1 | 1 |
| Q. Paper..... | 0 | 1 | 0 | 1 |
| R. Containers and packing methods..... | 0 | 5 | 0 | 5 |
| S. Tools..... | 0 | 6 | 0 | 6 |
| X. Rational numbers..... | 1 | 0 | 0 | 1 |
| Total..... | 190 | 114 | 41 | 345 |

The Ministries of Interior and Public Works have approved a series of 13 important road signs, standardized as to sizes of lettering, colors, dimensions of signs, donor's name, height from ground, and other details. This series was recommended by a committee composed of representatives of touring clubs, automobile associations, the National Tourist Office, and the French Automobile Chamber of Commerce. The new markings cover signs showing directions and distances, turns, railroad crossings, entrances into towns, etc.

The French Standards Association maintains representation in the Institute of Commercial and Industrial Organization (Institut d'Organisation Commerciale et Industrielle) which was recently organized by the Paris Chamber of Commerce, with the encouragement of the Minister of Commerce and the Undersecretary of State for Technical Instruction, for the purposes of coordinating the activities of the various French organizations which devote part or all of their time to finding systems and methods of aiding the progress of the rational organization of production and trade; promoting, by their centralization, the development of the studies relating to such matters; and arriving at practical conclusions from the results so achieved.

The institute consists of a directors' committee, a financial commission, and a consulting committee. This last group, besides representatives of the Paris Chamber of Commerce and the French Standards Association, contains representatives of the Ministry of Commerce, the Undersecretariat for Technical Instruction, the National Committee for French Organization, the Commission of Scientific Organization of Work of the General Confederation of French Production, the Statistical Institute, the Laboratory of Experimental Psychology, and the Laboratory on the Physiology of Work.

There follows a list of some of the standards approved by the Higher Commission on Standardization:

Metallurgical products.—Nomenclature of aluminum and alloys; aluminum ingots, plates, and strips, and electrical conductors; low and high resistance alloy plates, strips, tubes, bars, and sections; pure platinum; platinum-copper; platinum-iridium; platinum chlo-

ride; industrial lead; and industrial tin (ingots, rods, plates, sheets, strips, and tubes).

Construction materials.—Burned-clay and silicocalcareous bricks; tiles; natural and artificial cut stone; glass for windows and mining lamps; nomenclature and testing methods for wood; timber; joinery wood for doors, windows, etc.; and wood for paving blocks.

Electrical industry.—Electrotechnical vocabulary; international symbols; standard annealed copper; electrical machinery; sections of copper and aluminum bars for distribution boards; armored cable insulated with impregnated paper; carbon brushes; aluminum wires and cables; range of current intensity for electrical apparatus; large electrical fittings; diameters of copper conductors; bases and slabs of marble, slate, and other insulating material used for large electrical fittings; and meter terminal boxes.

Machine elements.—Threads; profile of screw threads; play and tolerances for threads; standard countersinks; rough or machined square-head or hexagonal-head bolts; rough or machined cylindrical-head bolts; rough or machined round-head bolts; rough or machined countersunk-head bolts; large square-head bolts; cambered-head bolts, square collar (Japy bolt); countersunk or cambered-countersunk wood bolts; wheel bolts; plowshare bolts; prismatic-head metal screws; slotted-head round or cylindrical metal screws; slotted-head countersunk or cambered-countersunk screws; rough or machined stud bolts; length of shank, length of thread, and shrinkage allowances for bolts and stud bolts with a single nut and for screws, diameters 5 to 36 mm; length of shank, length of thread, and shrinkage allowances for bolts and stud bolts with nut and lock nut, diameters 6 to 36 mm; hexagonal rough or finished nuts; square nuts; standard castle nuts; cotter pins; taper pins; rivets; headless flat-end and pointed-end screws; square-head and fillister-head pointed-end screws; square-head dished screws; headless, square-head, cylindrical-head and hexagonal-head teat-screws; technical drawings (arrangement of projections and cross-sections; lines; hatchures; lettering; margins and shaping; threads; indication of pieces of revolution); machine tool centers; center drills; milling-machine arbors; high castellated and pin nuts; round nuts; collar nuts; T slots and tongue slots; grips for cranks, hand wheels, levers, etc.

Cycles and automobiles.—Driving gear of tachometers, taximeters, etc.; carburetor gaskets; spark plugs; radiator filling plugs; housing dimensions of tachometers, thermometers, speedometers, ampere-meters, etc.; batteries; carburetor shut-off valves; brake lining; timing and firing; bolts, nuts, screws, rivets, washers, and pins; automobile bumpers; machine tool centers; license plates; carburetor adjustment levers; electric lamps; steering wheels; feed pipes; generators; head lamps, search lamps; light, medium, and heavy ball bearings; rubber-hose connections for water systems; industrial vehicles; control pedals; straight valves and valve threads for pneumatic tires; magnetos; grease cups; standard countersinks; accelerators; metal rims for cycles; pumps for cycles; lamp holders for cycles; speedometers; and motor-cycle batteries.

Miscellaneous.—Copper and brass round, hexagonal, and square bars, struts and hollow bars, trolley wires, and sheets; aluminum sheets, bars, tubes, and sections; test pressure for acceptance of new stationary boilers; and rational numbers.

Germany.—Deutscher Normenausschuss (DNA), Dr. Engineer Hellmich, managing director, Berlin NW. 7, Dorotheenstrasse 47, Germany.

The German Standards Committee is an organization for public benefit, composed of producers, distributors, consumers, scientists, and Government officials, which conducts German standardizing activities. Each group in German industry sets up standards in accordance with the principles of the Standards Committee, and submits the results to the central body of this committee for admission into the field of standardization. An editorial committee reviews each standard for form and style, as well as for agreement with existing standards. Completed standards carry the legally protected symbol DIN, which, originally meaning "German Industry Standard," to-day is applied to all classes of standards.

When standards originate in other organizations, they are given their place in the general collection of standards. Some of the bodies which cooperate with the DNA are the Society of German Professional Engineers (ADB), Committee for Economic Production (AWF), Committee for Economic Management (AWV), German Metallurgical Association (DGfM), German Association for Testing Engineering Materials (DVM), National Committee on Specifications (RAL), and Union of German Engineers (VDI).

The number of completed German standards, as given in the annual standards catalogue, is over 3,200. More than 1,000 projects have been published for criticism, and further proposals are in preparation. These figures are not inclusive of the work of the Merchant Marine Standards Committee (HNA), which has completed 1,200 standards and is working on 100 others.

There is given below a review of the various classes of German standards. The first table summarizes the "Dinormen," or standards prepared under the supervision of the DNA. The second table comprises "Fachnormen," standards prepared by affiliated organizations, which bear not only the DIN designation but also the indicated symbol of the parent organization.

TABLE 1

| Classification | Number of standards | | Classification | Number of standards | |
|--|---------------------|-----------|------------------------------------|---------------------|-----------|
| | Total | Completed | | Total | Completed |
| General fundamental standards and technical fundamental standards..... | 340 | 320 | Machine tools..... | 367 | 331 |
| Gas masks..... | 3 | ----- | Furniture..... | 5 | 3 |
| Fittings (valves, pressure gages)..... | 134 | 39 | Sewing machines..... | 8 | 6 |
| Gas-welding industry..... | 14 | 14 | Photography..... | 7 | 4 |
| Burial practice..... | 1 | ----- | Piano construction..... | 5 | 2 |
| Building industry..... | 413 | 343 | Pipes and tubes..... | 208 | 127 |
| Library practice..... | 5 | 4 | Typewriters..... | 29 | 26 |
| Office and drafting equipment..... | 3 | ----- | Shoe manufacture..... | 8 | 8 |
| Steam boilers..... | 4 | 3 | Welding practice..... | 5 | 5 |
| Railroads..... | 32 | 30 | Construction materials..... | 92 | 79 |
| Bottles..... | 6 | 3 | Street-railway practice..... | 52 | 1 |
| Dispatching means..... | 1 | 1 | Transmission..... | 28 | 25 |
| Foundry practice..... | 7 | 2 | Welghing and testing machines..... | 2 | 1 |
| Housekeeping..... | 75 | 65 | Water turbines..... | 5 | 5 |
| Hoisting machinery..... | 18 | 16 | Tools..... | 277 | 211 |
| Heating..... | 5 | ----- | Machine tools..... | 51 | 36 |
| Trunks and baggage..... | 1 | 1 | Underground construction..... | 4 | ----- |
| Load and acceptance testing..... | 2 | 2 | Total..... | 2,217 | 1,713 |

TABLE 2

| Classification | Number of standards | | Classification | Number of standards | |
|-----------------------------------|---------------------|----------------|--|---------------------|----------------|
| | Total | Com- pleted | | Total | Com- pleted |
| Mining (BERG)..... | 250 | 160 | Agriculture (LAND)..... | 78 | 27 |
| Chemical apparatus (DENOG).... | 74 | 70 | Locomotive construction (LON)... | 491 | 392 |
| Printing trade (NAGRA)..... | 6 | 6 | Air travel (L)..... | 53 | 40 |
| Railway cars (WAN)..... | 76 | 67 | Material testing (DVM)..... | 35 | 16 |
| Electrical engineering (VDE)..... | 377 | 335 | National Committee on Specifica- tions (RAL)..... | 3 | 3 |
| Bicycle building (FAFA)..... | 44 | 43 | X-ray practice (RÖNT)..... | 2 | 2 |
| Fire fighting (FEN)..... | 44 | 19 | Shipbuilding (HNA)..... | 1,300 | 1,200 |
| Meat-cutting machines (VDF).... | 10 | 10 | Textile industry (TEX)..... | 103 | 43 |
| Woodworking machinery (VDH)... | 24 | 10 | Surveying practice (VERM)..... | 8 | ----- |
| Motion-picture industry (KIN).... | 7 | 7 | Total..... | 3,305 | 2,699 |
| Automotive industry (Kr)..... | 259 | 224 | | | |
| Hospital practice (FANOK)..... | 61 | 25 | | | |

Besides the individual standards leaflets, which are issued in the international size A 4 (210 by 297 mm), the standards committee publishes Dintaschenbücher (pocket handbooks), Dinbücher (manuals), and DIN-Wandtafeln (wall charts).

The pocket handbooks contain a large part of the standards of the DNA in certain lines of work, and are printed in size A 5 (148 by 210 mm) for handy reference. Handbooks have appeared on the subjects of fundamental standards; governing signs and symbols; technical rules for construction; standards for raw materials; contract form for construction work; tools; electrical machinery, transformers and apparatus; electrical wiring material, cables, and overhead lines; standard sections; bolts, nuts, screws, and rivets; gages; machine parts and working standards; installation material; street construction and drainage.

The Din manuals (size A 5) give a survey of the development, purpose, and direction for the development of certain classes of standardization work. Up to the present manuals have been published on form for standards, threads, screws, fits, transmission, drafting standards, keys, and cotters.

The Din wall charts, in size A 1 (594 by 841 mm) are intended for use in offices and schools, covering preferred numbers, standard diameters, paper sizes, wrench openings, and drafting rules.

Great Britain.—British Engineering Standards Association (BESA), C. le Maistre, C. B. E., director and secretary, 28 Victoria Street, London, S. W. 1, England.

Under its electoral system of management, brought about by the royal charter granted in 1929, the association's work is handled by industry sections. These sections, each of which deals with a different phase of standardization, appoint such technical committees as are necessary in the carrying out of standardization projects. Each section acts independently, using its own judgment in cooperating internationally in any particular project.

Between January and June, 1930, the association issued 22 new or revised specifications, bringing its total of specifications and reports to 395.

The Government has decided to increase its annual grant to the association from £105 to £3,000, with the additional provision that £1 extra will be contributed for every £3 that the association raises through industrial subscription in excess of £13,000. The total annual grant, however, may not exceed £5,000.

The Association of British Chemical Manufacturers, with the cooperation of the BESA, is sponsoring a program for the development of standardization, safety rules, and statistical analysis in the chemical industry. A proposal for the organization of a chemical standardization body received the enthusiastic support of the various chemical interests, and a special committee is investigating the proposed field of work.

The South African branch of the British Engineering Standards Association carries on the standardization in South Africa. This body consists of representatives of practically every Government department, mining firm, municipality, and technical society. Its committees cover the subjects of mechanical engineering, electrical engineering, civil engineering and architecture, chemical industry, agricultural implements, and explosives.

The South African branch reviews and criticizes drafts of proposed British standards, and popularizes the use of the completed standards in South Africa, adapting them where necessary to suit climatic and other local conditions. In addition, the organization has prepared its own standards for the subjects of lime, coal sampling, coal analysis, white metal alloys, soaps for industrial purposes, and water pipes and fittings.

In the Standards Yearbook for 1930 was given a partial list of standards published by the British Engineering Standards Association. Other approved standards are as follows:

Gypsum plaster; asphalt for roofing; sand-lime brick; cast-iron soil, heavy rainwater, and ventilating pipes; schedule of grades for commercial plywood; paints, varnishes, and paint materials; schedule of colors for ready-mixed paints; definition of fire resistance; methods of testing timber.

Wire and manila ropes, derrick cranes; tramway axles; twist drills; grinding wheels; circular saws; lathe centers; leather belting; rubber belting; spur and helical gearing; engine indicators; compressed air receivers; welding; chains and fittings; rope terminal attachments; engineering symbols and abbreviations.

Steels; iron and steel castings; spark plugs; magnetos; piston rings; splines; electric cables and wires; switches and circuit-breakers; carbon-filament lamps; generators and motors; insulating materials; aluminum and copper conductors for overhead power transmission; electric fans; primary and secondary batteries.

Concrete pipe; road tar; sampling and analysis of coal; soft, silver, and brazing soldiers; zinc; copper; airplane dopes; portable photometers; optical projection apparatus; and classification of symmetrical light distributions from lighting fittings.

Hungary.—Magyar Ipari Szabványosító Bizottság (MISz), Ed. Gellért, secretary, Reáltanoda utca 13–15, Budapest IV, Hungary.

During the past year, the Hungarian Engineering Standards Committee has approved no new standards, but the number of standardization projects under way has been increased to 78. A summary of the work of the committee, as of July 1, 1930, is given in the table.

| Industrial groups | Standardization projects | |
|--|--------------------------|-----------|
| | Total | Completed |
| A. Civil engineering and building industry..... | 9 | ----- |
| B. Mechanical engineering..... | 38 | ----- |
| C. Electrical engineering (Hungarian Electrotechnical Commission)..... | 14 | 11 |
| G. Ferrous metallurgy..... | 12 | ----- |
| I. Engineering drawing practice..... | 7 | ----- |
| M. Mining..... | 6 | ----- |
| P. Paper industry..... | 1 | ----- |
| Z. Miscellaneous..... | 5 | ----- |
| Total..... | 92 | 14 |

The fourteen standards already approved by the Engineering Standards Committee cover the items: Paper sizes; application of paper sizes; sizes of drawing papers and scales for drawings; standard voltages for three-phase alternating current; standard voltages for direct current; primary and no-load secondary voltages of standard transformers; standard voltages of three-phase generators; copper wire; aluminum wire; rubber-insulated conductors; specifications and tests for machines and transformers; testing iron laminations; lead-covered cables; and insulating oils for transformers. The electrical standards were prepared by the Hungarian Electrotechnical Commission, an organization formed in 1920 for establishing standards in the field of electrotechnics. This body maintains close cooperation with the Engineering Standards Committee.

At present, 12 sectional committees are functioning under control of the Engineering Standards Committee, on the subjects of engineering drawing practice, machine parts, tolerances, building materials, piping, house-heating equipment, coal and bituminous materials, ferrous metallurgy, and paper industry. Twelve special committees are working out standard forms of building contracts. A sectional committee for the preparation of standard specifications and tests for lubricating oils is at present being organized.

Italy.—Ente Nazionale per l'Unificazione nell'Industria (UNI), I. Locatelli, general secretary, Foro Bonaparte 16, Milano, Italy.

The new National Association for Industrial Standardization was established by the Royal Decree of July 18, 1930, under the auspices of the General Fascist Confederation of Italian Industry. For some time the Confederation of Industry had realized the great importance of the activity of technical and industrial standardization as a form of modern discipline indispensable for the progress of industry and for national economy. With the object of giving to standardizing activities an adequate organization and a more ample development, the confederation promoted the formation of the new association, with full control over the various branches of industry, advantageously transforming and enlarging the committee for standardization in the Mechanical Industry (UNIM), which was created in 1921 through the initiative of the National Association of Mechanical and Affiliated Industrialists.

The purposes of the new organization, as set forth in its constitution, 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. In order to attain its goal, the organization may maintain contacts with technical organizations in other countries.

Membership in the UNI is accorded to syndicates adhering to the General Fascist Confederation of Italian Industry; other scientific, technical, professional, corporate, and economic organizations, which have among their aims, the promotion of activities in harmony with the work of standardization; interested Government departments; and the Committee for Civil Mobilization. A minimum annual payment of 25,000 liras is required of members.

The UNI is controlled by a board of directors composed of representatives of member organizations, and whose president is elected by the General Fascist Confederation of Italian Industry. The board of directors decides on applications for membership; determines the best means for popularizing the work of standardization, and for assisting the practical application of the results attained by the UNI; approves the budgets of the organization and handles its finances; establishes general rules for the functioning of the Central Technical Commission and the technical committees; ratifies the proposals and decisions of the Central Technical Commission; and harmonizes the work of the UNI with the directives of the General Fascist Confederation of Italian Industry. An executive committee, composed of the president, the two vice presidents, and two other members of the board of directors, develops the aims of the organization, and exercises all other functions assigned to it by the board of directors.

Standardization projects are prepared 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. After any necessary revisions, projects are edited and submitted to the board of directors, which may approve them as Italian standards.

A general secretary, appointed by the General Fascist Confederation for Italian Industry, provides for the organization and operation of the offices and services of the UNI and discharges the duties assigned by the president, the executive committee, and the board of directors.

No report is available concerning the progress of the Standards Association. However, 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, different types of threads, standard diameters, tolerances and fits, bolts and screws, splines, limit gages, and keys and key ways. Many of the published standards were 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, Tokio, Japan.

In its latest report, the Japanese Engineering Standards Committee announces the approval of 109 standards, with work progressing on 45 other projects, as shown in table.

| Classification | Approved | Under way |
|---|----------|-----------|
| A. Civil engineering and building trades..... | 13 | 1 |
| B. Mechanical engineering..... | 22 | 12 |
| C. Electrical engineering..... | 8 | 4 |
| E. Transportation..... | | 3 |
| F. Naval architecture and marine engineering..... | 11 | 8 |
| G. Ferrous metallurgy..... | 26 | 4 |
| H. Nonferrous metallurgy..... | 17 | 6 |
| K. Chemical industry..... | 7 | 6 |
| O. Wood industry..... | 2 | ----- |
| P. Pulp and paper industry..... | 1 | ----- |
| Z. Miscellaneous..... | 2 | 1 |
| Total..... | 109 | 45 |

The use of specifications in Japan has been greatly facilitated by an order from the Department of Commerce and Industry to the effect that Japanese Engineering Standards shall be mandatory upon the various Government departments.

In organizing its program, the committee gives preference to the standardizing of materials having the greatest use in industry, but which, because of a lack of standards, are found to be inconvenient and disadvantageous in their production, consumption, and handling. In connection with the work on a standard, studies are made on such collateral subjects as test pieces, preferred numbers, methods of analysis, limit gages, and drawings.

The preparation of a standard involves the drafting of the proposal by the technical subcommittee, with the aid of expert advice, the results of scientific experiments, and criticism by interested parties. Foreign standards for similar subjects are taken into consideration. After approval by the sectional meeting, drafts are brought before the general meeting for final approval as standards.

Besides the Engineering Standards Committee, other Japanese organizations engaged in standardization are: The Japanese Electrotechnical Commission, the Electrical Association, the Japanese Technical Society of Portland Cement, the Associated Society of Building Materials, the Osaka Limit Gage Society, the Society of Naval Architects, and the Association of Chemical Industry. These bodies maintain close contact with the Engineering Standards Committee, and are of great assistance in its work.

The Japanese Electrotechnical Commission, whose 30 members are appointed from the membership of the Electrical Association, is engaged in the unification of technical terms concerning electricity, and the drafting of standards for electrical machinery and apparatus. As a member of the International Electrotechnical Commission, the committee is in contact with the progress of electrical work abroad. The committee has played a prominent part in preparing the drafts of various Japanese Engineering Standards for electrical materials.

The Electrical Association, an amalgamation of several Japanese electrical associations, is engaged in the standardization of such

commodities as high-voltage insulators, single-phase oil-immersed transformers for use on poles, and electric cables for mines.

The Association of Chemical Industry, formed in 1918, is working toward the development of the chemical industry, and in 1927 made a proposal to the different Government departments regarding measures to be taken for this development. A committee was formed by the association for the study of oils and paints.

The Japanese Technical Society of Portland Cement encourages the establishment of standards for cement and its manufacture, and prevention of disasters. A standard for sand has been developed, also a standard test method for Portland cement to be used by the Government.

The Associated Society of Building Materials aims at standardization of the grades, dimensions, and designations of building materials. Specifications for dimensions and designations of lumber and common brick, prepared by this association, have been approved as Japanese Engineering Standards. The association also prepared the drafts for standards on roofing tile, stone earthenware pipe, and slate.

The Osaka Limit Gage Society is engaged in the study of various systems of limits and fits in use in Japan and in foreign countries. The society is drafting specifications on this subject for submission to the Engineering Standards Committee.

The Society of Naval Architects is composed of representatives of dockyards, shipping companies, and other interested Government and private organizations. It has engaged in the unification of existing standards for ship's equipment, and the preparation of standards for other marine engineering subjects.

The metric system law, effective on and after July 1, 1934, provides that all new standards shall be in accordance with the metric system. The application of the metric system to standards for materials produced mainly in Japan, such as lumber, brick, roofing tile, stone, and earthenware pipe, presents few difficulties; however, in certain industries introduced from Great Britain and the United States, machines and tools must, to a considerable extent, be imported, since Japanese production is at present insufficient to meet the demand. Consequently, in standards for such items as screws, structural steel, steel tubes, and drills, two systems have been provided, one of the English system converted into metric measurements, and one using purely metric units. In some cases, a system of metric measurements mixed with English measurements, has been provided to meet the requirements for the time being.

Netherlands.—Hoofdcommissie voor de Normalisatie in Nederland (HCNN), secretary J. A. Teyinck, director of the Centraal Normalisatie Bureau, Koningskade 23, The Hague, Holland.

Since its institution in 1916 through the Society for Industry and the Royal Institute of Engineers, the General Committee for Standardization in the Netherlands has extended the sphere of its activity to such fields as mechanical engineering, electrical engineering, shipbuilding, architecture, locomotion, drafting and graphics.

In 1929, 35 new standards were issued and 49 published for criticism, making a total of over 300 standards and about 150 tentative

standards. The results of its work in 1930 have not been made available.

The general committee contains about 20 members, the most prominent persons of industry, commerce, and science, functioning as the representatives of the large groups interested in standardization. Its rôle is one of general direction and coordination of standardizing activities, and of approval of standards.

The standards themselves are the work of technical committees, composed of representatives of producing, commercial, and consuming organizations, together with scientific experts. Work on a project is begun only on satisfactory evidence of a general interest. At present 43 technical committees are in operation, which, with their 47 subcommittees, have a membership of more than 600 persons, all serving without compensation. The Central Standardization Bureau, with a personnel of about 20, functions as secretariat for these committees.

The conclusions of the technical committees are published as projects. After criticism of form and style by an editorial committee, these projects are subjected to the approval of the general committee, and are then published in the technical press for a period of 6 months, to invite general comment and criticism. The projects are then returned to the technical committees for any necessary changes, given final approval by the general committee, and published as standards. To encourage their wide distribution, the price of standard sheets is set very low.

Some of the subjects on which standards have been published or work is in progress, are given below.

Mechanical engineering.—Rivets, bolts and screws, various kinds of machine-tool work, pipe lines and fittings, containers for compressed gases, steel wire, chains and hooks, calibers and tolerances, fire-fighting equipment, and sieves for testing purposes.

Electrical engineering.—Wire, cables and cable fittings, insulation and installation material, standard voltages, safety codes for electrical systems and installations, and incandescent lamps.

Shipbuilding.—Anchor chains, cables and rope work, scuttle ports, parts of rigging, loading equipment, and bollards.

Architecture.—Tests for wood, natural stone, brick, art stone, bonding materials, tile, bituminous materials, dry paints, prepared paints and oils for paints, iron and steel, and sanitary service and equipment.

Locomotion.—Ties and ballast material for railways and tramways, standardization of narrow-gage railways, and traffic signals on the right of way.

Miscellaneous.—Arrangement of technical drawings, sizes and weights of paper, maps, card systems, proofreaders' marks, glass bottles for milk, beer, carbonated beverages, and wine, and hospital textiles and furnishings.

Norway.—Norges Industriforbunds Standardiseringskomite (NIS), Kaare Heiberg, secretary, Drammensveien 4, Oslo, Norway.

The work of the Norwegian Standards Committee is now being carried on by 40 sectional committees, with a personnel of about 200. The latest available report, dated April 1, 1930, lists 227 standards which have received the approval of the NIS, and which may be classified by groups as in the table.

| Groups | Standards |
|---|-----------|
| General..... | 8 |
| Drawings and drawing-room practice..... | 24 |
| Mechanical engineering..... | 116 |
| Shipbuilding..... | 5 |
| House building..... | 56 |
| Packings and packing cases..... | 18 |
| Total..... | 227 |

A partial list of approved standards was given in the Standards Yearbook for 1930. Among the standards which recently were approved by the NIS are the following: Black, semifinished, and bright square and hexagon nuts and bolts; Whitworth and metric threads; set screws; wing nuts and screws; sunk taper keys; gib-head keys; sunk feather keys; Woodruff keys; key-bars; and keyways for tangential keying.

Special attention is being paid to packing methods and materials. The committees working in this field are composed of representatives of the sawmills, wooden-case manufacturers, fishing, agricultural, and market-gardening industries, the import and export trade, Norwegian State railways, shippers' associations, coastal trade and steamer associations, and hotel and restaurant proprietors. Standards have been adopted for wooden cases for fish, fruits, vegetables, cheeses, and butter, and for sacks for potatoes, carrots, and cabbages. Other standard packings are being developed for berries, eggs, and jams and jellies. In order to encourage the use of standardized packings, the Norwegian State railways have announced that fruit packed in standard containers will be carried at reduced rates.

The following table shows the number of projects on which work progressed during the second half of 1929.

| Groups | Projects |
|--------------------------------|----------|
| A. Civil engineering..... | 14 |
| B. Mechanical engineering..... | 30 |
| F. Shipbuilding..... | 10 |
| G. Ferrous metallurgy..... | 14 |
| Z. Miscellaneous..... | 11 |
| Total..... | 79 |

These projects include: Builder's hardware; building specifications, inquiry, and contract; brick; concrete pipe; screw threads; bolts and nuts; hand tools and machine tools; pins and washers; shafting; pipes and fittings; bollards; anchor chains; hatchway and batten cleats; stanchions; ventilators; fittings for cargo booms; iron and steel; agricultural implements; and fish nets.

Poland.—Polski Komitet Normalizacyjny (PKN), A. Rogiński, director, Ministerstwo Przemysłu i Handlu, Elektoralna, 2, Warszawa, Poland.

The report of the Polish Standardization Committee shows the completion of 272 standards, with work in progress on 496 proposed standards, which may be summarized as in the table.

| | Proposed standards | | Proposed standards |
|-----------------------------|--------------------|--------------------|--------------------|
| Aircraft..... | 25 | Textiles..... | 10 |
| Civil engineering..... | 300 | Automobiles..... | 24 |
| Mechanical engineering..... | 90 | Miscellaneous..... | 12 |
| Metallurgy..... | 15 | | |
| Chemical industry..... | 15 | Total..... | 496 |
| Fuels and lubricants..... | 5 | | |

The main body of the Polish Standardization Committee consists of 54 delegates and alternates, including a director appointed by the Minister of Commerce and Industry, and representatives of the various Government departments, industrial, economic, and scientific organizations, and higher institutions of learning. Two-thirds of its expenses are borne by industry, the remainder by the Ministry of Commerce and Industry.

Routine business is carried on by an office committee, which conducts correspondence and keeps the archives of the PKN; exchanges information with foreign standards bodies; compiles information needed by the technical committees; transmits proposals to the main body for consideration; publishes the work of the PKN; and carries on advertising and propaganda.

Technical work is handled by 20 technical committees, which, with their 50 subcommittees and 37 sections, have a membership of over 500 persons. The names of these technical committees are as follows:

- I. General Committee.
- II. Committee on Ferrous Metals.
- III. Committee on Piping.
- IV. Committee on Fire Fighting.
- V. Committee on Sanitation Equipment.
- VI. Committee on Building Construction.
- VII. Committee on Machine Parts.
- VIII. Committee on Tolerances and Adjustments.
- IX. Committee on Machinery.
- X. Committee on Automobiles.
- XI. Committee on Steam Boilers.
- XII. Committee on Chemical Technology.
- XIII. Committee on Aviation.
- XIV. Committee on Textiles.
- XV. Committee on Leather.
- XVI. Committee on Ameliorations.
- XVII. Committee on Grain.
- XVIII. Committee on Nonferrous Metals.
- XIX. Committee on Classification of Coal Sizes.
- XX. Committee on Wheels and Wagons.

The general committee is composed of the director of the PKN, a secretary, and the chairmen of all technical committees. It handles proposals of a general character, such as terminology, markings, forms, and drawings, and investigates certain aspects of all proposals. The technical committees are made up of balanced numbers of scientists, producers, and consumers. Subcommittees and sections are created as necessary. Committees may begin work on projects on their own initiative, with the knowledge of the director of the PKN.

Projects completed by technical committees are transmitted to the main body for its consideration, and are then published in the official technical journal for three months to invite comment and criticism. After any necessary adjustments by technical committees, the projects may then be accepted as standards. On decision of committee chairmen, a standard may at any time be subjected to revision.

For some time the Polish Standardization Committee has been actively interested in the formulation of an international standard for coal sizes. The matter was brought before the International Standards Association at its conference in Paris in May, 1930. As a result, a recommendation was adopted regarding the appointment of an ISA technical committee on the subject, the proposed secretariat to be in Poland, and the scope of the work to be: Methods of sampling and analysis of coal, and classification of coal on the basis of size.

The PKN is also concerned with standards for sieves, and for several years past has been collecting sieve data with a view to obtaining international agreement in the matter.

In addition to the Polish Standardization Committee, there are now established in Poland five other organizations, for the purpose of promoting specific standardization: The Polish Electrotechnical Committee, which engages in electrotechnical standardization; the Standards Commission of the Ministry of War, the primary aim of which is the unification of war materials; the Ministry of Communications, which covers the standardization of materials used exclusively by the railroads; the Institute of Scientific Organization, an independent commission of the PKN, which is very helpful in introducing and applying Polish standards; and the Polish Committee on Power, which participates in the work of the World Power Conference and its International Executive Board; gives opinions in matters connected with the production, distribution, and application of power in every form; and cooperates in supporting activities tending toward the rational use of power, in supporting and collecting scientific publications relative to the use and production of power, in collecting data for the preparation of a balance sheet on the use and production of power in Poland, and in the popularization of information concerning the basis of proper use and production of power.

Rumania.—Comisiunea Romana de Normalizare, P. P. Dulfu, secretary, 6 rue Clemenceau, Bucharest 3, Rumania.

The Rumanian Committee for Standardization, organized in 1928 by the Rumanian Institute of Scientific Management, aims at the simplification of economic activity, coordination of standardizing activities, and representation of the standardization movement at home and abroad. The organization is composed of representatives of the various Rumanian interests concerned with standardization. It is operated by an executive committee of 10 members.

Work is contemplated or is actually under way, on standardization projects for such subjects as a Rumanian technical dictionary, drill tubing for use in the oil industry, mechanical parts, transmission belts, and forms of purchase specifications.

In January, 1930, there was established under the auspices of the Ministry for Commerce and Industry, a Rationalization and Stand-

ardization Office, to establish specifications for materials purchased by the Government, and to rationalize the Government administration. This office will make use of standards created by the Committee for Standardization, and foreign standards on subjects for which standards do not exist in Rumania. It maintains the closest cooperation with the Rumanian Committee for Standardization.

Russia.—Standards Committee (OST), Council of Labor and Defense, Union of Socialist Soviet Republics, Z. A. Papernoff, secretary, Varvarka 12, Moscow, U. S. S. R.

The Russian economic program, which is now being carried out according to a carefully elaborated plan, has created conditions particularly favorable to standardization work. It is acknowledged that all reconstruction work must be based on standards, and consequently the creation of standards must go forward with all rapidity for the early reestablishment of the country's economic prosperity. The Government has given a great impetus to standardization in providing penalties for infractions of Russian standards.

Preparatory standardization work, such as the simplification of sizes of industrial products, the selection of the most rational types of constructions and machines, and the establishment of standards for the consumption of raw and semifinished materials, has been systematically introduced into every plan of reorganization of individual branches of industry, and is vigorously carried on as most important for the concentration of production, specialization, and cooperation of manufactories. In this connection, the establishment of a standard system of fits and tolerances is recognized as of paramount importance.

But this represents the primary stage in the standardization problem and calls for full consideration by the Standards Committee of the results obtained, with a view to the establishment of quality standards for finished materials.

The Standards Committee solicits the close cooperation of the various consuming interests in formulating its annual programs for standardization work.

The increasing activity of the Standards Committee is shown by the numbers of completed standards published from year to year. Up to October 1, 1927, 125 standards had been approved by the committee; from that time to October 1, 1928, 221 standards were approved; and in the following year, 378 standards were approved. Between October 1, 1929, and July 1, 1930, the number of approved standards was 772, while it was expected that during the last three months of 1929–30, 500 or 600 additional standards would receive approval, bringing the total of Russian standards, on October 1, 1930, to well over 2,000.

The following table illustrates how the approved standards are distributed among the different industrial groups.

| Industrial groups | Number | Industrial groups | Number |
|---------------------------------------|--------|-----------------------------|--------|
| Agriculture..... | 180 | Petroleum industry..... | 25 |
| Building..... | 70 | Silicates and ceramics..... | 46 |
| Chemistry..... | 204 | Textiles and clothing..... | 98 |
| Foodstuffs..... | 116 | Transportation..... | 170 |
| Electrotechnics..... | 40 | Woodworking..... | 50 |
| Leather and furs..... | 90 | | |
| Metallurgy..... | 330 | Total..... | 1,446 |
| Paper manufacturing and printing..... | 27 | | |

The growth of the standardization movement has necessitated a reorganization of the technical committees functioning under control of the Standards Committee, with a consequent increase in personnel.

Besides directing the progress of standardization work throughout the country, the Standards Committee is also authorized to supervise general adherence to standardization laws. As a result, all State bureaus of weights and measures, whose principal duty is to verify the adherence of materials to standard samples, and the bureau of inspection for metals, coal, and chemicals, are subordinate to the Standards Committee.

Sweden.—Svenska Industriens Standardiseringskommission (SIS), Amos Kruse, general secretary, Malmtorgsgatan 10, Stockholm 16, Sweden.

The Swedish Industrial Standards Committee, organized in 1922 at the initiative of the Swedish Industrial Association, supervises and coordinates the work of standardization in the various fields of Swedish industry. Expenses are paid largely by a Government subsidy. A central committee, the chairman of which is appointed by the Government, directs the standardizing activities of the various technical committees. The membership is representative of Swedish industrial and scientific organizations and Government departments.

According to the latest report, 288 standards have been approved by the committee, while 23 revisions and 161 new projects are under way. The status of work according to industrial groups is as shown in the table.

| Industrial groups | Approved | Under way | Revisions | Total |
|---|----------|-----------|-----------|-------|
| A. Civil engineering and building industry..... | | 15 | 3 | 18 |
| B. Mechanical engineering..... | 263 | 57 | 14 | 334 |
| C. Electrical engineering..... | 5 | 13 | 1 | 19 |
| E. Transportation..... | | 1 | | 1 |
| F. Shipbuilding..... | | 1 | | 1 |
| G. Ferrous metallurgy..... | 1 | 2 | | 3 |
| M. Mining..... | | 62 | | 62 |
| N. Agriculture..... | 11 | 5 | 3 | 19 |
| O. Wood industry..... | | 2 | | 2 |
| P. Pulp and paper industry..... | | | 1 | 1 |
| R. Glass and pottery..... | | 2 | | 2 |
| Z. Miscellaneous..... | 8 | 1 | 1 | 10 |
| Total..... | 288 | 161 | 23 | 472 |

Standardization in mechanical engineering is carried on by the Swedish Society of Mechanical Engineers, in cooperation with the SIS. Since the last report, 20 mechanical engineering standards have been completed, bringing the total to 263. Through the SIS, the Society of Mechanical Engineers has taken part in a number of international standardizing conferences. Among those subjects on which committees are working are metric thread systems, screws and bolts, tolerances, roller bearings, drafting-room practice, standard diameters, pipe and fittings, keys, couplings, axle heights, axle ends, and pressure tests for boilers.

The Electrical Standardizing Commission (ESK), which also functions as the Swedish Electrotechnical Commission (SEK) and handles the Swedish operations of the International Electrotechnical Commission, is in charge of standardizing activities in the electrical field. With the cooperation of other electrical societies, the Electrical Standardizing Commission has drafted a series of Swedish

electrotechnical standards, and is working along the following lines: Insulated leads, insulation materials, electrical heating appliances, symbols and nomenclature, electrical machine standards, hoisting apparatus, copper wire, insulators, power and regulatory devices, high and low voltages, transformers, lightning arrestors, and fuses.

The Office for the Promotion of the Iron and Steel Industry has worked out and published a proposed Swedish standard for machine tools and machine parts, which has been distributed among various industries for criticism. The question of standards for iron and steel was taken up by this office in 1928 in connection with international work in this line, and has been divided into two parts, namely, for strength tests, and for dimensions and tolerances.

The Committee for the Standardization of Building Materials has been working for several years on a revision of a standard building catalogue, first published in 1921. In cooperation with other Scandinavian countries, standards are being prepared for timber dimensions and tongues and grooves for planed lumber.

Agricultural standardization is divided into two parts, commercial and technical. The Technical Society for Agriculture has published a proposal for Cambridge and ring rollers, and has taken up the simplification of types and sizes of plowshares.

Standardization has entered, to greater or less degree, into numerous other Swedish industries. Subjects on which work has been proposed, or is actively going forward, include hospital chinaware and porcelain ware, fire prevention materials, porcelain sanitary ware, bicycles, castings, and general terminology.

Switzerland.—Schweizerische Normalien-Vereinigung (SNV), H. Zollinger, secretary, Zurich, Lavaterstrasse 11, Switzerland.

Standardization work in Switzerland is controlled by the Swiss Standards Association, an organization composed of representatives of the various national institutions interested in standardization. Completed standards are issued by the standards bureau of the Vereins Schweizerischer Maschinenindustrieller, the Society of Swiss Machine Industrialists. These published standards, most of which are printed in French as well as in German, now number over 300, and include such subjects as drawings; steel wire rope; screw threads; pipe threads; bolts, nuts, screws, washers, pins, and rivets; stoppage plugs; standard diameters; keys; ball bearings; hand grips; cones; T slots; milling machine attachments; machine tool centers; tool squares; grinding wheels; screw keys; elevators; kitchen stoves; tolerances; pressure gauges; and valves for pressure gauges.

A concerted effort for the elimination of waste in labor is being made in Switzerland by the Commission Romande de Rationalisation, an organization formed in 1929, with headquarters at Geneva, 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. Not only are technical questions dealt with, but also problems necessitating the collaboration of science and various economic organizations. The commission's work is expected to increase the output of work and diminish net costs, and thus to better the general living conditions.

United States of America.—American Standards Association, P. G. Agnew, secretary, 29 West Thirty-ninth Street, New York, N. Y. (See Ch. VII, p. 269.)

IV. FEDERAL STANDARDIZING AGENCIES

Among other duties, the Federal Government through its various agencies, establishes standards for its own protection and for the benefit and protection of the people. These standards are the result of governmental research, study, experience, and also cooperation between the various agencies of the Government and industry. The following outlines of standardization and specification making activities of the Government have been based on information supplied by the respective agencies. Information concerning earlier activities and accomplishments of Government agencies can be found in the Standards Yearbooks of 1927 to 1930.

EXECUTIVE DEPARTMENTS

DEPARTMENT OF AGRICULTURE

BUREAU OF AGRICULTURAL ECONOMICS

Standardization work since the last issue of the Standards Yearbook has consisted chiefly in perfecting existing standards and in extending their use rather than in the formulation of additional standards. There is now an urgent demand for standards to apply to fruits and vegetables for canning purposes; therefore, in addition to those for cannery tomatoes, already in use, standards for canning spinach have recently been formulated, and work toward standards for other cannery commodities is planned.

Evidences of consumer interest in standards have increased during the year and have stimulated work for consumers. For instance, about 50,000,000 pounds of beef were graded and stamped by grade, for sale on the markets (exclusive of beef stamped for Government hospitals and other Government institutions), and more than 700,000 turkeys were graded and stamped for the holiday trade. A device has been perfected for branding the grade name on U. S. Fancy Aged American Cheese as a result of grading by Federal workers at point of production.

Publications issued relating to standardization are as follows:

Technical Bulletin 154. A method for determining color of agricultural products.

Circular 103. Market classes and grades of dressed veal and calf carcasses.

Miscellaneous Publication 75. Method of testing capacity of fruit and vegetable containers under the United States standard container acts.

Service and Regulatory Announcement 117. Proceedings of the International Universal Standards Conference of 1928.

Service and Regulatory Announcement 118. Classification of leaf tobacco.

Circular 8, entitled "National Standards for Farm Products," has been issued in a revised form and a poster in colors has been issued for work in connection with cannery tomatoes. Plaster models have been devised for use in demonstrating the grades for hogs.

BUREAU OF CHEMISTRY AND SOILS

The carbohydrate division of this bureau has carried out investigations on maple-sirup standards. Suitably controlled standards are of great importance in the buying and selling of maple sirup. The work in this division has made possible the evaluation of the standard caramel and the Bryan color units in terms of per cent transmission of light at 560 mm in a 1-cm cell. These standards can now be made quickly by using any good grade of commercial caramel preparation.

The protein and nutrition division standardizes certain foods for their vitamin content and value. The results of this work are used in the enforcement of the Federal food and drugs act.

The industrial farm products division of this bureau participates, through its membership in 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 paints and oils, and leather products, of the Federal Specifications Board, and on the paper products and the leather and leather goods committees of the Federal Purchasing 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.

The fertilizer and fixed nitrogen investigations unit, in its work of the drillability of fertilizers, has made a number of measurements of the angles of repose and apparent specific gravities of samples of fertilizers which were furnished by the State chemists of New York, New Jersey, South Carolina, Georgia, and Tennessee. Measurements have also been made of fertilizers at factories and in the hands of farmers.

The usual range of angle of repose measurements is from 30° to 65° and the range of apparent specific gravity from 0.50 to 1.30. The delivery rate obtainable with most distributors when adjusted in any particular way varies greatly with both of these measurements. It is therefore impossible to calibrate distributors at the factory. For efficiency it is absolutely essential that a farmer should know how to set his implement to obtain the proper rate of application. He can not calibrate it once for all because the drillability of the same brand of fertilizer varies widely from time to time. He must, therefore, determine the necessary adjustments of his distributor every time he wishes to apply a fertilizer, or do his work in a wasteful and inefficient manner. Either course is very unsatisfactory and the only alternatives are the development of distributors capable of doing highly efficient work with any kind of fertilizer, or the standardization of fertilizers.

The bulk of the fertilizer used consists of complete mixtures. The mean angle of repose of 418 complete mixtures thus far measured in this laboratory is 41.4°, and 303 of the measurements fell between 38° and 43°. It is therefore tentatively recommended that an angle of repose of 40° be recognized as the standard for a complete mixed fertilizer. The mean apparent specific gravity of these

goods is 0.97. Fertilizer distributors deliver by volume, yet farmers wish to apply so many pounds to the acre. If the apparent specific gravity were 1 it would greatly simplify the problem. Since the mean is already near this value it is recommended that 1 be provisionally recognized as the standard for the apparent specific gravity of complete mixed fertilizers.

BUREAU OF HOME ECONOMICS

The Bureau of Home Economics is cooperating with the American Home Economics Association and the American Standards Association in an effort to set up standards for commodities being purchased by home makers. The chief of this bureau is a representative of the Department of Agriculture on the American Standards Council and a member of the staff is the representative of the American Home Economics Association on that council. Two members of the staff are members of the committee on Commercial Standardization and Simplification of the American Home Economics Association.

This committee recently petitioned the American Standards Association to invite manufacturers, distributors, and consumers to utilize their procedure for the consideration of specifications for refrigerators, bed sheeting, and blankets. Members of the bureau's staff are members of the technical committees now working on these specifications. In this connection, research on the measurements of the construction and performance of refrigerators and blankets is now being carried on by this bureau.

BUREAU OF PLANT INDUSTRY

Seed Laboratory

The laboratory, by continued participation in the Association of the Official Seed Analysts of North America, assists in formulating rules for testing of seeds. These rules are adhered to by seed-merchandising interests and seed-testing laboratories of United States and Canada.

This laboratory is represented on committees of the International Seed Testing Association. This organization assists international commerce in seeds by formulating rules governing the testing of seeds passing in international trade and by drafting a form of certificate to accompany such sales.

There is continued activity toward placing the work of all seed-testing laboratories on a more practical basis to the extent that reports of analysis will more accurately indicate the plant producing value of seed rather than an arbitrary tabulating value which often represents what may be expected from the seed under most favorable conditions.

The Federal seed act limits the quality of seeds imported, requires the coloring of imported alfalfa and red-clover seed for identification, and prohibits interstate shipment of misbranded seeds.

BUREAU OF PUBLIC ROADS

Considerable progress has been made in 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. The specification arrangement and phraseology adopted by the bureau and the American Association of Highway Officials has been set up as the standard, and at the present time 37 States have adopted the form of arrangement and at least a part of the phraseology.

As an aid in studying specification trends and practices, all State specifications received are analyzed and the elements entered in a continuing quick reference tabulation. Comparisons can be made between different years or different States which will show the trend of specification practice.

Other standardizing activities of the bureau, directed toward the production of standard specifications for road materials and methods of construction and the adoption of standards of practice in the highway field, have been carried on through cooperation with organizations which are national in their influence.

Cooperation with the American Association of State Highway Officials.—Through membership on various committees and subcommittees the bureau is assisting in the preparation of standard specifications in such a way as to promote uniformity without interfering with the adoption of betterments as they become evident. All specifications conform in form and arrangement with the standard outline of specifications adopted by the bureau and the association. Activity during the past year is described as follows:

Committee on Materials.—This committee, on which the bureau is represented by four members, is engaged in the preparation of standards governing methods of testing and specifications for road materials. Activities during the past year have had to do principally with revisions in the present tentative specifications of the association, as well as the preparation of certain new proposed methods of testing.

Committee on Bridges and Structures.—This committee is now engaged in the preparation of a tentative draft of specifications for movable bridges, as well as the revision of provisions governing the quality of concrete of the tentative standard specifications for bridges and incidental structures of the association. The committee is also engaged in the study of load restrictions on highways. The chairman of the committee is a member of this bureau.

Special Committee on Concrete Road Specifications.—This committee has completed the preparation of tentative standard specifications for the construction of concrete pavements. The chairman of the committee is a member of this bureau.

Special Committee on Brick Pavements.—This committee has completed its work and has been discontinued.

Special Committee on Bituminous Macadam Roads.—This committee, on which the bureau is represented by one member, is continuing the development of specifications for bituminous macadam roads of the penetration type.

Special Committee on Mixed Bituminous Tops.—This committee, on which the bureau is represented by one member, is preparing specifications for bituminous concrete and sheet asphalt wearing courses.

Cooperation with The American Society for Testing Materials.—Cooperation with this society is through membership on various committees.

Committee on Cement.—The bureau cooperates with this committee in its development of standard methods of testing and specifications for Portland cement by conducting tests and otherwise assisting in obtaining data for the use of the committee. The secretary of this committee is a member of this bureau.

Committee on Brick.—This committee is developing methods of test and specifications for brick.

Committee on Concrete and Concrete Aggregates.—The bureau is represented on this committee by two members. It conducts, from time to time, laboratory investigations at the request of the committee for the purpose of obtaining data which will assist in the standardization of methods of testing concrete.

Committee on Cast Iron.—The interest of the bureau in the work of this committee is chiefly in connection with specifications for cast-iron culvert pipe. A subcommittee has recently been formed, with a member of this bureau as chairman, for the purpose of studying this problem.

Committee on Corrosion of Iron and Steel.—This committee, on which this bureau is represented by one member, is continuing the study of factors which affect corrosion of iron and steel, with special reference to road culvert pipe.

Committee on Road Materials.—The bureau is represented on this committee by one member. It is engaged in the preparation of standard methods of testing and specifications for materials used in road construction, such as stone, gravel, slag, asphalt, and tar. Laboratory tests are conducted in cooperation with other members of the committee for the purpose of obtaining standardization data.

Committee on Clay and Cement Concrete Pipe.—This committee, on which this bureau has one member, is continuing its study of specifications for clay and concrete culvert pipe.

Committee on Methods of Testing.—The bureau is chiefly interested in the work of this committee because of the efforts which are being made to standardize procedure as regards methods of testing for size of mineral aggregates. There are so many conflicting interests that very little progress was made during the past year.

Cooperation with the American Concrete Institute.—Cooperation with this organization has been continued through membership on the Committee on Aggregates and the Committee on Concrete Road Specifications. The latter committee, on which the bureau is represented, will endeavor to coordinate its activities in connection with the preparation of standard specifications for concrete roads with a similar committee of the American Association of State Highway Officials, on which the bureau is also represented.

Cooperation with the Highway Research Board.—Cooperation with this organization is through membership on the following committees:

- Structural design of pavements,
- Materials and construction,
- Methods of curing concrete,
- Specifications for rail steel for reinforcing.
- Aggregates.

Each of the above committees is engaged in the coordination of various research activities in its particular field. Reports of progress are made annually to the board and are published in annual proceedings.

Cooperation with the Federal Specifications Board.—TECHNICAL COMMITTEE ON ROAD AND PAVING MATERIALS.—This committee has under its jurisdiction the preparation of Federal specifications for road and paving materials, exclusive of Portland cement and metallic materials. Activities during the past year have been concentrated on revisions of the 22 Federal specifications which have been promulgated. Complete revised specifications for fine and coarse aggregates for concrete pavement construction have been prepared. The chairman of this committee is a member of this bureau.

COMMITTEE ON CEMENT, LIMES, AND PLASTERS.—This committee prepares Federal specifications for materials of this type. A bureau representative is a member of this committee.

COMMITTEE ON LUBRICANTS AND LIQUID FUELS.—This committee is engaged in the preparation of specifications for materials of this type. A member of the bureau staff is a member of the committee.

COMMITTEE ON METAL CULVERTS.—This is a subcommittee of the metals committee of the Federal Specifications Board and is concerned with the preparation of specifications for metal culverts. A bureau representative is chairman of the subcommittee.

Cooperation with the American Standards Association.—The bureau has members on the sectional committee on Portland cement and the sectional committee on road materials.

FOOD AND DRUG ADMINISTRATION

The Food and Drug Administration of the United States Department of Agriculture is charged by Congress 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.—By act of Congress a standard for butter was established for use in the enforcement of the Federal food and drugs act. In general, however, definitions and standards for food products subject to the act are recommended by the food standards committee appointed by the Secretary of Agriculture. Definitions and standards adopted by the committee must receive the approval of the Secretary of Agriculture before they become officially recognized.

During the year revisions were made of the definitions and standards for mayonnaise salad dressing, for milk, for pasteurized milk, for skimmed milk, for goat's and ewe's milk; the definition for coffee was revised to include cultivated coffees of the robusta variety; definitions were adopted for fruit juice, grape juice, and orange juice; a definition was adopted for whole wheat flour, entire wheat flour; and the definition and standard for white flour was revised. Definitions were formulated, but not adopted, for various soda-water beverages and beverage flavors. These proposed definitions were

published for comment and criticism but have not been recommended for adoption.

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. Standards for the several classes of canned foods are in course of preparation. (The standards for food products now in force are given in Service and Regulatory Announcement, F. D. No. 2.)

Drugs.—A drug sold under or by a name recognized in the United States Pharmacopœia or National Formulary must conform to the standard laid down in the Pharmacopœia or Formulary. (Service and Regulatory Announcements, F. D. No. 1, p. 5 and 17.)

The cooperation between the administration and the Combined Contact Committee of the American Drug Manufacturers Association and the American Pharmaceutical Manufacturers' Association was continued during 1930. As a result of this cooperation during the year tolerances were recommended for three drugs in ampule form, so that at present tolerances have been recommended for 26 drugs in compressed or molded tablet form, 18 in hypodermic tablet form, and 3 in ampule form.

Tea Act

Objective tea standards were prepared and submitted by the board of tea experts and were established as standards under the tea act for the following:

Formosa Oolong (used for Foochow and Canton Oolong).

Congou.

Java (used for all fully fermented East Indian teas).

Gunpowder, green (used for all China green tea).

Japan.

Scented orange pekoe (used for capers).

Scented Canton.

These standards apply to tea shipped from abroad on or after May 1, 1930. Tea shipped prior to May 1, 1930, was governed by the standards which became effective May 1, 1929.

FOREST SERVICE

The Forest Products Laboratory of the United States Forest Service, located at Madison, Wis., assisted in the following standardization activities by representation in the respective organizations:

American Railway Engineering Association.—COMMITTEE ON WOODEN BRIDGES AND TRESTLES.—The association published, during the past year, a manual which presents the standard grading rules and working stresses for structural timbers adopted by the committee.

American Mining Congress, Standardization Division.—COMMITTEE ON MINE TIMBER PRESERVATION.—This committee has under consideration the adoption of standard specifications for preservatives and for treating methods. Voting on the report is now in progress, and definite action will be taken during the current year.

Technical Association of the Pulp and Paper Industry.—COMMITTEE ON ALKALINE PULPING PROCESSES.—This committee has been

considering the standardization of the nomenclature used in soda and sulphate pulp mills and has appointed a subcommittee to consider the terms used in describing certain analytical procedures.

The laboratory is represented on committees of the following standardizing agencies: The Federal Specification Board, the American Mining Congress, the American Standards Association, the American Society for Testing Materials, the American Railway Engineering Association, the American Wood Preservers' Association, the American Chemical Society, the Technical Association of the Pulp and Paper Industry, the American Institute of Chemical Engineers, the American Paper and Pulp Association, the American Association of Civil Engineers, and the Building Code Committee of the Department of Commerce.

OFFICE OF EXPERIMENT STATIONS

Such standardization activities as the experiment stations engage in are mainly in connection with farm operating equipment, such as machinery and structures. The standards for these in the long run are handled by the standards committee of the American Society of Agricultural Engineers whose headquarters are at St. Joseph, Mich.

DEPARTMENT OF COMMERCE

BUREAU OF FISHERIES

The original functions of the Bureau of Fisheries, did not specifically include standardization activities, however, several such activities have become necessary as a means of carrying out its principal functions. This has reference to studies to determine the most desirable methods of prosecuting the fisheries, preserving and maintaining the gear, and utilizing the catch. The bureau, however, has only advisory functions in this respect and submits the results of its studies to the fishing industries to receive application where desired.

Scientific investigators of the bureau have determined that the several types of gear require different types of preservative treatment. During the past year a brief paper was published in which several standard preservative treatments were listed and discussed according to the type of gear for which they were most applicable. Through the efforts of the bureau, the troublesome question of governing the size of the mesh of fishing twine is being studied in co-operation with the National Bureau of Standards in hopes of establishing not only a uniform standard for each size mesh, but a uniform method of measuring a mesh both in the field and in the factory.

The bureau has been studying methods of manufacturing fish meal, fish oil, and related by-products with a view toward standardizing present practices and methods of reduction, thereby decreasing losses now encountered. One of the recent conclusions drawn from this work is that the adoption of low temperature drying as a standard, in preference to drying by intense heat, would reduce loss of material and produce higher quality fish meals.

Biochemical studies and cooperative feeding tests have brought into being new standards of value and of usage for the various

products of the fisheries. The bureau is urging the use of fish meal as a feed-stuff rather than as a fertilizer. Nutritional studies have shown that the method of manufacture frequently has more influence on the nutritional value of the meal than the nature of the raw material. This may be expected to lead to the standardization of fish meals according to method of manufacture as well as the general type of raw material from which they were made.

The bureau is also studying improved methods of handling fresh fish. As the various possible improvements become more fully recognized the more desirable may be expected to acquire preference as more or less standard procedure.

BUREAU OF LIGHTHOUSES

The chief constructing engineer represents the Department of Commerce on the executive committee of the Federal Specifications Board, and members of the bureau represent the Department of Commerce on six technical committees of the Federal Specifications Board.

The bureau is a member of the American Standards Association, sectional committee on electrical installations on shipboard.

The Commissioner of Lighthouses has served for several years as the representative of the American Council on "Joint Conference on Standard Contract Forms," a conference which has worked under the auspices of the Department of Commerce.

The superintendent of naval construction represents the Department of Commerce on the board of managers of the American Bureau of Shipping, in connection with the classification of vessels owned by the United States in accordance with the merchant marine act of 1920 (sec. 25, 41 Stat. 988), and is a member of the committee on naval architecture.

The superintendent of naval construction is also a member of the executive board of the American Marine Standards Committee and of nine technical committees.

Various individuals of the bureau and the district superintendents of lighthouses (19) are constantly engaged at work making improvements on apparatus and methods for lighthouse service which lead to general standardization. Forty-seven such individual items have thus been standardized.

Current activities tending toward standardization include the following:

Radiobeacons and radio compasses.
Lights for aerial navigation.
Vessel moorings.
Iron and wooden buoys.

Synchronization of radiobeacons and aerial fog signals.
Primary cell lights.
Distant control of lights and fog signals by radio.

Improvements in Apparatus and Equipment.—The extension of commercial power lines, the design of dependable small generators, and the increased number of radiobeacon installations have made it practical and economical to increase the use of electricity for furnishing the current for lights and power to operate sound signals and other light-station equipment. Minor electric lights in considerable number have been installed in which the current for the lamp and for the operation of the flashing mechanism is furnished by

several primary cells or dry cells. In displacing oil lanterns by this apparatus the cost of maintenance is practically eliminated, and on the acetylene lights the cost of equipment reduced. Experimental installations of such flashing lights are being tested on buoys also, with a view to their more extended use where practicable.

Considerable study is still being given to the proper electric light for rapidly revolving lenses and for lightship lanterns. Improvements in the present electrical equipment on several lightships have been made and others are projected. Interesting experiments are under way to improve the light from the masthead of lightships by increasing the divergence of the beam. At several light installations where storage batteries are provided for auxiliary electric current supply, a relay system has been devised to cut in and out automatically the rectifier charging the battery.

Three light stations in the service are now equipped with wind electric plants for furnishing currents. At Kalae Light Station, Hawaiian Islands, because of the almost constant winds, it has been found practicable to give the battery a lower charging rate and keep it in an almost charged state.

During the year equipment was provided to replace all obsolete spark transmitters on lighthouse tenders with the latest type tube or modulated continuous wave transmitters, in compliance with the 1927 International Radio Conference. Further improvement in the design of transmitters to provide greater frequency stability, as well as compactness and ruggedness for service on lightships has been made. A continuous-wave transmitter was permanently installed at Cape Henry Lighthouse for observation and test as opportunity permits. Tests of last year indicate that the design and the principle is feasible pending the modernizing of existing ship's radiocompasses. A special low-power radiobeacon transmitter was also developed for use at harbor approaches and at points of lesser importance. These transmitters were designed to operate on 60-cycle alternating current, and to emit signals at any one of five tones from 400 to 1,600 cycles. This differentiation of tone will be tested as a third method of distinguishing between radiobeacon stations, in addition to characteristic and frequency. Over 30 transmitters of this type were built and installed during the year. A policy was adopted to operate all radiobeacons, with minor exceptions, for a definite period each hour during clear weather, this being made possible by the development of successful clock control, and automatic operation. This is being carried out as rapidly as the equipment can be installed. In this connection, an alarm system which will inform the keepers of any failure of the automatically operated radiobeacons during the operating period has been developed, with very satisfactory results.

Two more isolated stations in the service were interconnected and placed in touch with the shore through the installation of radiotelephones of low power. These installations are providing very proving very valuable in the efficient operation of the stations, and are also a potent factor in keeping up the morale of the personnel.

Synchronized radiobeacon and sound-in-air signals, similar to that placed at Cape Henry in 1929, have been installed at five other stations, and are being tested. By this means the navigator is able to determine his distance from the station at any time when he can hear the signal.

A further test was conducted during the year of a system previously developed of remote control of fog signal by radio. The device has been permanently installed at an important station and is in constant use to control the operation of a fog signal at a near-by station. This apparatus makes it practicable to place an efficient minor fog signal out at the point of danger and control it from shore.

A number of fog signals of the vibrating disk type are in commission, and these types of signals are being further investigated. The replacement of worn out steam fog-signal plants with more modern equipment has been continued during the year. At Manitou Island Light Station, the diaphone fog signal has recently been fitted with two resonators, a vertical mushroom horn and a long, flared horizontal horn. Alternate blasts are sounded on each, the signal from mushroom horn for all directions of the compass, and from the long, flared horn for maximum audibility in the direction of the most used shipping lane.

Development of equipment for use on lighted airways is being continued. Further improvement was obtained in the illumination of the standard wind cone through the use of a full parabolic reflector installed in the base of the cone. A new motor-driven sign flasher was designed utilizing cam-operated mercury tubes for obtaining desired code flashes. Amber lenses on course lights installed at intermediate fields were discontinued and green adopted as the standard color. Further refinements were made in the astronomic dial time switch. Improvements were made in the standard control cabinets. A ventilator system was developed for the standard code beacon, so that 500-watt lamps can be used as light sources without undue heating of the 300 mm fresnel lenses for use as the standard auxiliary airport beacon. Arrangements were made for the use of a monoplane filament instead of the semibarrel type used heretofore in the standard 1,000-watt, 110-volt, T-20 beacon lamp, reducing the aviation lamps to a single standard for all purposes. Service tests were made of 3KVA single-phase, full automatic engine-generator sets for use at sites where commercial current is not available, and where distances between power plants and beacons require transmission of power at high voltages.

BUREAU OF MINES

Members of the Bureau of Mines represent the department on several technical committees of the Federal Specification Board and on 24 sectional committees of the American Standards Association. The bureau is also a member of the A. S. A. Mining Standardization Correlating Committee and the Safety Code Correlating Committee.

Among the investigations closely concerned with standardization in which the bureau, in cooperation with various technical and scientific agencies, was especially active in the obtaining of pertinent data in 1930 are the following:

- Methods for sampling, analysis, and testing of coals.

- Plasticity of coal.

- Quantitative determination of fusain in coal.

- Methods for determining 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.

Micropyrometer method for determining fusibility of coal ash.
 Classification of North American coals.
 Accelerated method for determining the slacking properties of coal.
 Methods for determining coal friability.
 Improved apparatus for the quantitative air separation of very fine sizes of powders.
 A rapid method for the determination of potassium.
 Ore dressing and grinding methods.
 Transfer of heat from a moving gas stream to a column of irregular solids.
 Method of testing blasting devices.
 Methods of testing strength of explosives.
 Water determination in explosives.
 Mine Safety Board.
 Experimental mine.
 Coal-dust explosion hazards in surface plants.
 Coal-mine ventilation code.
 Ventilation requirements of coal mines.
 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.
 Cooperative methods of first-aid instruction.
 Mine safety standards.
 Methods for reporting mine accidents.
 Uniform mine-accident statistics.
 Specifications for lubricants and liquid fuels, and method for sampling and testing.
 Measurement of flow of gases.

Methods for Sampling, Analysis, and Testing of Coals.—The work of the coal analytical laboratory of the Bureau of Mines consists chiefly of analysis of coals belonging to or for the use of the United States Government. The methods used in this analytical work are described in Bulletins 22, 85, 116, 119, 123, 193, and 230 and Technical Papers 8, 76, and 133.

In the course of this work, the methods used by the bureau have been widely adopted in many laboratories, or are used as a standard check in comparing results of other laboratories. Samples are exchanged with several commercial laboratories for the purpose of checking their methods of analysis and to improve their standards. Referee analyses are often made.

Plasticity of Coal.—A new method and apparatus have been developed for determining the plasticity of coal when heated under coking conditions to various temperatures.

Quantitative Determination of Fusain in Coal.—A method and apparatus have been developed for quantitatively determining the amount of fusain in coal.

Methods for Determining Agglutinating Value of Coal.—Methods for determining the agglutinating value of coal are being studied with special reference to the use of sand and Acheson graphite as inerts.

Methods for determining the Melting Point, Plasticity Range, and Setting Temperature of Coal.—Methods are being studied for determining 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.

Gas, Coke, and By-product Making Properties of American Coals.—In cooperation with the American Gas Association the

Bureau of Mines has developed a method and apparatus for determining the gas, coke, and by-product making properties of American coals in charges of 80 to 100 pounds. The method includes quantitative determination of yields and the physical and chemical properties of all the products. The properties of the coals, as shown not only by the usual chemical analysis, but by new and less usual physical and chemical tests and by microscopic examination, are being correlated with the carbonization results.

Classification of North American Coals.—The Bureau of Mines is cooperating with the American Standards Association's sectional committee on the classification of coal by contributing the chairman of the committee and performing certain laboratory work in connection with the development of suitable testing methods and the interpretation of data thus obtained.

Accelerated Method for Determining the Slacking Properties of Coal.—An accelerated test is being developed, in cooperation with the American Standards Association, sectional committee on the classification of coal, for determining the slacking or weathering properties of coal. The test is being applied to various ranks of coal and it is hoped that it will be helpful in differentiating between bituminous and subbituminous ranks of coal.

Methods for Determining Coal Friability.—Methods for determining the friability and resistance to breakage of coal by both shatter or drop tests and tumbler tests are being investigated in cooperation with the American Standards Association's sectional committee on the classification of coal as an aid to coal classification.

Improved Apparatus for the Quantitative Air Separation of Very Fine Sizes of Powders.—The customary methods for air elutriation of fine powders have been greatly improved by the Bureau of Mines during the past year. Fractions can now be cut within a very few microns in size.

A Rapid Method for the Determination of Potassium.—A method depending upon the precipitation and titration of potassium acid tartrate which can be carried out in less than 30 minutes has been developed and found to be suitable for rapid determinations of potassium.

Ore Crushing and Grinding Methods.—Work has been continued at the Intermountain Experiment Station of the Bureau of Mines, Salt Lake City, Utah, and at the Mississippi Valley Experiment Station, Rolla, Mo., on the development of methods for determining the fundamentals lying behind the crushing and grinding of ore and the development of new formulas to describe such conditions whenever old ones have been proven inadequate.

Transfer of Heat from a Moving Gas Stream to a Column of Irregular Solids.—Extensive work by the North Central Experiment Station of the Bureau of Mines, Minneapolis, Minn., has been done toward developing a mathematical equation expressing the manner in which heat is transferred from a moving gas stream to a column of irregular solids.

Method of Testing Blasting Devices.—Test requirements for permissible blasting devices other than permissible explosives have been formulated, and three such devices tested and approved. These devices employed as the blasting agent liquid carbon dioxide confined in a steel shell.

Methods of Testing Strength of Explosives.—Work is in hand which aims to afford information of value in standardizing methods of testing the propulsive strength of mining explosives and to select the method which best represents the performance of an explosive in actual blasting. During the past year, work has been completed on the Trauzl lead block.

Water Determination in Explosives.—Dynamites of the permissible type often contain, in addition to hygroscopic moisture, salts having water of crystallization. Analysis is made even more difficult by the frequent presence of the slightly volatile ethylene glycol dinitrate. A standardized method for the analysis of these explosives has been developed.

Mine Safety Board.—The mine safety board of the bureau (comprised of representatives of different technical divisions) formulates decisions on certain questions of mine safety which, on approval by the director, form the basis of teaching and policy in making recommendations on standard mining practice to the mining industry.

Experimental Mine.—Relative explosibilities of coal-mine dusts from different mines of the country are tested from time to time with the object of determining the proper means of preventing coal-dust explosions. In addition, the following problems are receiving consideration: The effect of the location of coal dust in mine passages on the explosibility with the object of determining the best means of lessening the hazard; the effect of small percentages of inflammable gas on the relative explosibilities of different dusts; the minimum quantity of methane under different conditions that will ignite coal dust; the minimum electric arc or spark which will ignite coal-dust in suspension; determination of factors in generalized rock dusting for prevention of coal-dust explosions with a view to modifying the code formulated by the Bureau of Mines and approved by the American Standards Association; the effect of size and character of rock dust as a means of preventing coal-dust explosions in mines; the distribution of rock dust to prevent coal-dust explosions; rock-dust barriers for approval by the Bureau of Mines; the strength of mine stoppings that will resist explosions, a cooperative investigation with the National Bureau of Standards, with a view to formulating specifications for coal-mine regulations on the public domain.

Coal-dust Explosion Hazards in Surface Plants.—The bureau has assisted in the betterment of safety codes, in cooperation with the Dust Explosion Hazards Committee of the National Fire Protection Association, more especially for the installation of pulverized fuel systems, coal pneumatic cleaning plant installations, and the use of inert gases for preventing explosions and fires.

Coal-mine Ventilation Code.—In cooperation with the American Institute of Mining and Metallurgical Engineers a code covering the best practices of ventilation in coal mines is being developed.

Ventilation Requirements of Coal Mines.—The bureau cooperated with the American Mining Congress in preparing standard methods for ventilation of coal mines. This code was issued March 15, 1929.

Ventilation Requirements of Metal Mines.—The bureau is cooperating with the American Mining Congress and other agencies in preparing a proposed standard code for ventilation of metal mines.

Mining Community Health and Safety Work.—As part of its efforts to bring about greater safety and health not only in mines, but also in mining communities, the bureau has organized and aided in the maintenance of a considerable number of Holmes Safety Chapters through which safety and health data are given not only to the miners, but also to their families. Up to July 1, 1930, there had been 198 of these organizations fostered by the bureau.

Uniformity in the Methods at First-Aid Contests.—As part of the bureau's field work in advancing the training of miners in methods of first aid to the injured, the bureau has for a number of years fostered the holding of a considerable number of first-aid contests. At present the holding of these contests is very widespread, there being far more than one hundred of them annually, in which the bureau's personnel not only helps in the team training before the meets, but also prepares the problems, makes up the discount sheets for the judges, and in many instances chooses and instructs the judges, or even does the judging.

Mine Gas Indicators.—An important part of the bureau's permissibility system lies in making field tests of the apparatus and the promulgation of data as to the limitations as well as capabilities of the apparatus as applied to use in mines. Field tests are made of the safety and efficiency of methane detectors with the aim of providing data which might be used in standardizing this type of equipment.

Gas Masks for Use in Mining, Metallurgical, and Allied Industries.—The bureau has adopted definite routine tests to determine the safety of gas masks when worn in known concentrations of various mining and industrial gases. The limitations as to the use of gas masks are of utmost importance. Although gas masks may offer full protection to the wearer in so far as breathing is concerned, some gases absorbed through various parts of the body may be harmful. The standardization of limiting conditions in actual use is equally as important as the ability of the mask to give full protection. The bureau, through its tests and field observations, provides information which is being used generally by the various industries in the establishment of standards of gas masks and for their use.

Mine Rescue Methods and Apparatus Used in Mine Rescue Work.—Mine rescue work is hazardous, and unless conducted along definite lines of careful procedure may endanger the lives of the rescuers as well as of those to be rescued. The bureau has conducted courses of instruction in standardized methods of mine rescue procedure and has given demonstrations in the proper use and limitations of rescue apparatus. Such instruction has been supplemented by the publication of essential data contained in the course. The bureau's recommended practices have been very widely accepted as standard by the mining industry in the United States.

The handbook on Self-Contained Mine Rescue Oxygen Breathing Apparatus has been revised, enlarged and reissued.

Cooperative Methods of First-Aid Instruction.—The benefit of having all men at a mine or a plant instructed in first aid has led to the adoption of a standardized method of instruction whereby key men are given thorough training by Bureau of Mines' instructors,

and these key men, under the supervision of the bureau, train all men in the mine or plant. This method is rapidly being adopted as standard by the mining industry as well as by other industries more or less allied to mining.

The manual of instruction in first aid has been revised to include new methods and to further standardize the methods of instruction of the Bureau of Mines, which are used also by other Government agencies and industrial organizations.

Mine Safety Standards.—Frequent and at times urgent requests are made for standard forms of mine safety procedure. Suggestions to govern the safety and welfare of coal miners in mines other than anthracite mines have been prepared and similar suggested methods of procedure for metal mines and for the petroleum industry are in course of preparation. The bureau's engineers have assisted the mining department of various States in connection with phases of their regulations or codes; in one State aid was given in formulating regulations governing drilling oil and gas wells through workable coal beds; in another State suggestions were given as to suitable rock-dusting requirements, etc. A course of instruction in prevention of coal-mine accidents is in preparation. The object of this course is to teach a standardized method of mine safety in the production of coal. There are also in preparation a series of scenarios for talking moving pictures illustrating safety methods and practices in coal mines.

The bureau has cooperated with the National Safety Council in preparing several papers on standard safe practices in the mining and allied industries.

Methods for Reporting Mine Accidents.—The Bureau of Mines has prepared a standard form of report for the use of mining and quarrying companies in reporting mine accidents.

Uniform Mine-accident Statistics.—The need for comparable statistics of accidents for mining and other industries is recognized by all accident-prevention engineers. For this reason the bureau participates in the general movement in the United States to prepare accident statistics for all industries on a comparable basis.

Specifications for Lubricants and Liquid Fuels and Methods for Sampling and Testing.—Standardization work dealing with these specifications consisted in the formulation of preliminary drafts of revisions to existing specifications for motor fuels, in connection with the work of the Committee on Lubricants and Liquid Fuels of the Federal Specifications Board.

Two semiannual gasoline surveys were made to determine the quality of motor fuels marketed in the United States. The results of these surveys and a study of the sulphur content of the gasoline sampled during the twenty-first survey were published. The correlating laboratory and refinery studies of sulphur in petroleum were continued. Progress has been made toward a revision of the specifications for lubricating oils, which work probably will be completed in time for use in making purchases for the fiscal year beginning July 1, 1931.

Measurement of Flow of Gases.—The Bureau of Mines has continued work on three major problems of standardizing methods for measuring natural gas.

In cooperation with the National Bureau of Standards and the American Gas Association on the measurement of gas flow with the orifice meter, natural gas engineers of the Bureau of Mines assisted in planning experimental work, in actually carrying out some of the experiments, and in analyzing the results of tests, preparatory to issuing a set of tentative recommendations. Publication of the recommendations and supporting data, which will follow, rests with the National Bureau of Standards and American Gas Association.

The study of flow of natural gas through high-pressure gas-transmission lines has progressed to a point where, with a few exceptions, the actual field work has been completed and a final report, to be issued as a Bureau of Mines bulletin, is in preparation. The remaining tests consist of check runs on telescopic lines to determine whether or not actual deliveries are appreciably higher than the substitution of values in Weymouth's formula indicates. The bulletin will contain complete data on all tests and much additional information regarding conditions of lines and methods of testing, which were not included in Serial 2942. It is planned to include a revision of Serial No. 2942 with the original table, augmented and brought up to date, in the American Gas Association Code Book.

Since publishing the 2-part treatise, "The study of a fundamental basis for controlling and gaging natural gas wells" (Serial Nos. 2929 and 2930) in 1929, the Bureau of Mines has continued the important work of gathering data from a large number of gas wells in different fields. Many of these data are gathered by engineers of member companies of the American Gas Association, who are intimately familiar with the project; thereby making it possible to extend the scope of the work. Natural gas engineers of the Bureau of Mines personally attended the orifice tests which were conducted in the Texas Panhandle and Deer Creek Field, Oklahoma. In connection with the field tests a large number of orifices were calibrated and tests made to determine critical and noncritical flow conditions through orifices of larger diameter than those used previously. This work has broadened the field of investigation with reference to flow of gas from wells. A third companion report on the fundamental study of gas well flow is in preparation.

COAST AND GEODETIC SURVEY

The Coast and Geodetic Survey continued the standardization of its instruments and equipment. Particular attention is being given to reducing the number of sizes of screws, and the standardization of instrument parts to permit interchangeability and replacements in the field.

The standards and specifications adopted for its own hydrographic and geodetic work continue to be adopted by other nations, the United States thus occupying a place as a leader in hydrographic and geodetic theory and practice.

The magnetic work continues to be 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.

In the production of charts, symbols have been standardized not only nationally, through the Federal Board of Surveys and Maps, but internationally, through the International Hydrographic Bureau. The number of styles of lettering used is being reduced, making it practicable to do more lettering by mechanical means.

In the preparation of airway maps, not only the symbols and lettering have been standardized, but the limits of the sections made to conform to those adopted for the International Million Scale Map of the World, a step greatly desired by librarians for the easy classification and description of maps in general.

Representatives of the Coast and Geodetic Survey have been active members of the Federal Board of Surveys and Maps, and of committees of the Federal Specifications Board.

OFFICE OF THE SECRETARY

The National Committee on Wood Utilization, is composed of 155 members representing the Government and private organizations of consumers, distributors, and producers of forest products functioning to bring about closer wood utilization and better manufacture and distribution of forest products.

Fifty-five national associations are represented on the committee. During the past year the committee has completed and issued publications relating to the following subjects: The uses and economies of treated lumber, devoted to a discussion of the methods of preserving lumber and the possible use of treated lumber by the small consumer; the results of the test of the Scandinavian gang saw in converting small logs into lumber; a report on a veneer edge gluing machine which eliminates the use of tape; the second volume of a series of bulletins containing suggestions for making useful and ornamental objects from discarded wooden containers and odd pieces of lumber; a treatise on the use of wood in rayon production; the report on sawdust, wood flour, and shavings has been revised and enlarged.

The second edition (consumers) of the series of bulletins to encourage the more extensive use of small-dimension stock, is in preparation, as are also publications treating of the following subjects: Education of the public as to what is good design and construction in furniture; the use of insulating material in house construction; a bulletin for the prospective home owner relative to the points to be considered when judging a house; a manual for carpenters treating of light frame construction. The projects of the committee are promoted through the efforts of its members who make recommendations to the trade groups with which they are affiliated and by means of educational exhibits and publicity. In its efforts to put its recommendations into practice the committee cooperates with Government agencies as well as with other consumers and producers.

STEAMBOAT INSPECTION SERVICE

For several years it has been the desire of the Steamboat Inspection Service to draft a boiler code that would be second to none in the world. A special committee has been formed to review the boiler

code, as drafted by this service, with a view to harmonizing any differences that may exist between that boiler code and the boiler code drafted by the American Marine Standards Committee, the boiler rules of British Lloyds, etc., with a view to having a standard code, and a code that will represent the best modern practices.

Representatives of the Steamboat Inspection Service have also been cooperating in the establishment of standard specifications for life preservers intended to be used by the Government departments.

DEPARTMENT OF INTERIOR

BUREAU OF RECLAMATION

This bureau is represented on two technical committees of the Federal Specifications Board, and on two sectional committees of the American Standards Association.

Standardization work that has been approved since September 26, 1929, and now being used by the Bureau of Reclamation includes the following:

- 36, 42, and 48 inch diameter screw-lift gates.
- 10:1 worm-gear gate hoist, single or multiple units, power operated.
- 20:1 worm-gear gate hoist, single or multiple units, power operated.
- Line shaft for above.
- 8-inch internal differential needle valve, hydromechanical control.
- 42-inch internal differential needle valve and controls.
- 48-inch internal differential needle valve and controls.
- 54-inch internal differential needle valves and controls.
- 60-inch internal differential needle valves and controls.
- 16 to 18 feet radial gate heads, 5 to 6 feet.
- 16 to 18 feet radial gate heads, 6 to 7 feet.
- 16 to 18 feet radial gate heads, 7 to 8 feet.
- 18 to 20 feet radial gate heads, 6 to 7 feet.
- 8 to 10 feet radial gate heads, 6 to 7 feet.
- 2:1 spur gear set.
- 2:1 bevel gear set.
- Metering float switch.
- Cipolletti weir blades, 2 to 8 feet crest.
- Reversing switch cabinet pipe rail mounting.
- Concrete pipe turnouts, single barrel, 18 to 24 inches diameter.
- Concrete pipe turnouts, double and triple barrel, 30 to 60 inches diameter.
- Stems for cast-iron gates, 2 to 3½ inches diameter.

Now being prepared:

Special designs for the Boulder Canyon Dam, power plant, and appurtenant works on the Colorado River are in preparation.

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 30 groups and classes of machinery and structures, including 600 drawings.

A revised list of publications (No. 8) has recently 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 butter, eggs, poultry, green fruits, and vegetables, are required to conform to the standards set up by the Bureau of Agricultural Economics, Department of Agriculture.

In the matter of hospital activities, the 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.

NATIONAL PARK SERVICE

Standardization of specifications for the purchase of equipment and supplies for the various national parks is a difficult matter to adhere to. The needs of the individual parks vary greatly as regards details even for the same general class of supplies.

The field headquarters division, during the buying season from January 1 to July 1, 1930, prepared specifications for approximately 300 different articles, the various individual articles having been combined in 131 contracts—many of them for joint purchase for several parks. These specifications have covered a great variety of commodities, including practically everything in the machinery or equipment line which is used in the operation of the national parks.

Such purchases have included: 10 to 80 h. p. tractors, variously equipped; air compressors of various capacities, together with drills, jack hammers, sharpening tools, air hoists, and other allied appurtenances; power drag-saws, power snowplows, blade graders, and many other road-making tools; electric hand saws; motor cycles; oil-burner stoves; folding-camp stoves; power saw tables; road oil distributors of various sizes; oil tanks from 800 to 30,000 gallons capacity; dynamite of various grades; caps, fuze, and electric exploders; portable fire pumps and accessories; fire hose; air hose; tents of many sizes; folding steel camp cots and mattresses; power shovels, one-half yard and three-quarters yard; porcelain enameled signs; reinforcing steel for bridges; telephone material of many kinds; water tanks of 1,000 to 3,000 barrel capacity; blankets, complete heating plants for buildings of various capacities; complete refrigeration plants of various capacities for several parks; trail oil furnaces; complete lighting systems for several parks; electric-operated trip hammers; shingle stain, and special formula paint; complete camp and kitchen outfits of aluminum for 10 and 35 men camps; oxyacetylene welding outfits; road oil of various consistencies; emulsified asphalt; electric floor polishers; special orchard wagons; garbage cans; pipe and plumbing supplies of indefinite variety; lawn spray nozzles; sewage treatment plant supplies; sewage pumping plants; power meat slicers; power valve grinders; pumps of many varieties; gasoline and Diesel engines; power street sweepers; and many varieties of passenger automobiles and trucks.

During the period mentioned the service purchased 72 automotive trucks of capacities ranging from one-half ton to 5 tons, equipped with various classes of bodies and special equipment as needed by the park for which purchased.

With the great variation required in various parks, even for the same class of equipment, this service has been unable to write a standard specification which could be used in all cases; but, certain clauses have been standardized, particularly in truck specifications covering, in general, the particular requirements of all of the national parks with regard to sturdiness, and ability to perform satisfactorily under any weather conditions.

This service has also standardized on clauses which will determine the fitness of various motor-driven equipment, by a method of comparison between equipment of various makes when considered with the definite limitations set forth in the specifications, and with recognized published ratings.

Thus, in the matter of motor trucks, this service has a standard questionnaire which must be filled out by all bidders, covering the equipment bid on, and these data are used in determining the fitness of the truck in its constituent parts to meet the specified loading and other requirements of the specifications.

With regard to other equipment, this service has standardized specifications as to requirements as nearly as may be, giving due consideration to changing commercial practices.

About a third of the machinery and equipment specifications are now standardized from year to year, and the service maintains a supply of specification sheets which can be drawn upon at any time, and with the addition of a bid sheet can be circulated on short notice. It is endeavored to so write all specifications, as requirements are determined, that repetitive writing on minor articles would become unnecessary, except at rare intervals.

In the writing of specifications for supplies, such as dynamite, blasting powder, caps and fuse, paints and stains, cement, and other commodities of a like nature, the service has standardized on certain specifications which are being used whenever the occasion arises.

This service has endeavored to follow simplified practice recommendations whenever applicable to the particular needs of the supply purchase in hand. They are also using to a great extent, the Federal specifications, in so far as they will apply to purchases without the necessity of a laboratory test to determine compliance.

In the purchase of paints or pigments, cement and like articles, samples are mostly submitted to the local bureau of standards for determination of compliance, if time allows; but, in the purchase of textiles, or most raw materials which are covered by Federal specifications, the service is obliged to rely upon the approved list of certified manufacturers as a determination of the fitness of the products purchased, inasmuch as most such purchases are of an emergency order and there is not sufficient time to have laboratory tests made to determine compliance.

A more or less standardized specification has just been devised for various classes of motor vehicles and motor-operated machinery, this being in skeleton form with complete standard sheets giving general information which will be the same for all machinery, with special complete sheets covering the class of machinery to be bought and the specific requirements for the particular article. It is hoped it will thus be possible to make up a set of truck specifications, for example, whether it be for a 1-ton truck or a 5-ton truck, by using

these standard sheets with suitable inserts as to the power unit required, and the various measurements and dimensions and other special data required for each individual truck. These special single sheets may be changed as often as stock models for the class of machinery desired are changed, without changing the whole specification.

OFFICE OF INDIAN AFFAIRS

This bureau has revised and enlarged certain of their specifications heretofore used in connection with the purchase of some articles, as for instance, the specification for pianos which has been revised after communication with many of the leading piano manufacturers. This has resulted in the formulation of a specification which will be the means of procuring a better grade of instruments, and at the same time, appears acceptable to the trade. After consulting with representatives of other branches of the Government service and with various manufacturers, the specifications for X-ray equipment have been revised and now appear satisfactory in every way.

There was also prepared and adopted a specification for passenger-carrying elevators which meets Indian Service requirements for service in two and three floor stop hospitals.

New specifications were prepared and used for the first time this year for case furniture. These specifications have resulted in procuring a more substantial grade of furniture.

This bureau is represented on several committees of the Federal Specifications Board.

ST. ELIZABETHS HOSPITAL

St. Elizabeths Hospital has been cooperating with the Federal Specifications Board in standardizing various specifications for use in the institution. This hospital has been doing everything possible to agree upon standardized forms for contracts, leases, proposals, bonds, and all other paper work of the hospital that would lend itself to standardization with other branches of the Government and commercial institutions.

The hospital has agreed upon the standardized forms for rendering reports for financial and statistical use not in conflict with reports required by law. In this way statistical reports are rendered on forms similar to those requested by the National Committee on Mental Hygiene, and of mental institutions, and others on those recommended by the American Medical Association.

Representatives of the hospital are very often in conference in classifying care and treatment of its patients, as well as segregation in proper buildings and proper wards. As the care and treatment of mental patients are the primary objects of this institution all other work might be said to be by-products, and while in connection with such care and treatment the hospital has an up-to-date power, heat, and lighting plant, and includes mechanical equipment of all sorts in making various supplies, shoes, brooms, and brushes, in its laundry, bakery, etc., yet the hospital is somewhat limited in its standardization, subject to the requirements connected with the patients.

DEPARTMENT OF LABOR

BUREAU OF LABOR STATISTICS

The Commissioner of Labor Statistics represents the Department of Labor on the executive committee and the executive council of the American Standards Association.

By arrangement with this association the workers' representatives on safety code committees are selected and appointed through the Department of Labor, by the Bureau of Labor Statistics.

Practically all of the American Standards Association codes which deal with safety of workers are published by the Bureau of Labor Statistics.

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.

The bureau is represented on the safety code correlating committee of the American Standards Association.

In its survey of productivity and longshore labor conditions in the principal ports of the United States the bureau will emphasize 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 waterfront in order to mitigate the hardships of unemployment and underemployment which are inherent in this most casual of all industries.

It also has connections with the various State bureaus of labor statistics having for its purpose the standardization of methods of collection and tabulation of statistics. It sends experts to the various States to plan their statistical policies and methods whenever called upon, with a view to such procedure.

CHILDREN'S BUREAU

During the year the Children's Bureau has carried on the following activities relating especially to the development of standards:

Assistance in birth-registration campaigns in one State (all but two States are now in the birth-registration area).

Cooperation with State boards of health in 15 States in a study according to a uniform plan of causes of maternal mortality.

Collecting on a uniform schedule, and compiling, reports on employment certificates issued to working children in various States and cities. For the calendar year 1929 such information was obtained from the District of Columbia, 18 States, and 51 cities in 15 other States.

Collecting on uniform cards, and compiling information concerning juvenile-court cases of delinquency, dependency, and neglect. About 150 courts are now cooperating, and reports for the entire calendar year 1929 were tabulated for 96 courts in 27 States and the District of Columbia.

Collecting and compiling current statistics in child welfare and related fields. Monthly reports are received from 1,870 social

agencies in 39 cities. This work was formerly done by the Joint Committee of the Association of Community Chests and Councils and the Local Community Research Committee of the University of Chicago, which are now cooperating with the bureau.

Preparation (not yet completed) of a handbook on the administration of mothers' aid, undertaken at the request of the National Committee on Public Aid to Mothers of Dependent Children in Their Own Homes.

Plans for a second conference of State departments of public welfare, to be held at the Children's Bureau in 1931, to discuss problems of dependency and child protection, especially methods of obtaining uniform statistics of child dependency.

WOMEN'S BUREAU

The following is a brief outline of the general standards that have been submitted and recommended by the Women's Bureau for safeguarding the interests of women workers:

Hours of Labor.—Not more than an 8-hour day, including two 10-minute rest periods; not less than one and one-half days of rest in the week; no night work; and at least 30 minutes for a meal during the workday.

Wages.—Adequate wages based on occupation, not on sex.

Working Conditions.—COMFORT AND SANITATION.—Clean work places, with special attention to floors to prevent slipping; enough light, but no glare; comfortable temperature; provision against excessive heat and cold; adequate ventilation; provision against heat, humidity, dust, fumes; pure and accessible drinking water; individual cups or sanitary fountains; sanitary and accessible washing facilities; hot and cold water, soap, individual towels; sanitary toilet facilities, separate for men and women, in the ratio of 1 installation for every 15 women; dressing rooms for change of clothes, rest rooms for rest periods; and a clean, comfortable lunch room, with hot food where possible.

POSTURE AND PHYSICAL STRAIN AT WORK.—A chair for each woman, built on posture lines, adjusted to both worker and job. Neither constant standing nor constant sitting; mechanical devices to prevent unnecessary and repeated lifting of heavy weights for women, and other motions abnormally fatiguing to women.

SAFETY AND HEALTH.—Guarded machinery; protection against fire and other hazards; no prohibition of women's employment in any industry except those proved by scientific investigation to be more injurious to women than to men; protection against health hazards involved in contact with poisonous fumes or substances or the handling of material which, because of some process in its preparation or conditions, might cause an infection or in other ways affect the well-being of women workers or conditions surrounding the industrial processes in which women are engaged; and adequate first-aid equipment.

Home Work.—No industrial home work for women.

NAVY DEPARTMENT

BUREAU OF AERONAUTICS

The Bureau of Aeronautics and the Army Air Corps are continuing their program of standardization of aeronautical materials, processes, and design requirements. Each standard is considered not only on the basis of its military value, but with a view toward its adaptability to commercial aeronautics as well. This procedure was found necessary and desirable because of the lack of standardization within the industry. Army-Navy standards are primarily intended, however, for use by the military branches of the Government. Originally they covered a few of the more important materials used in the construction of aircraft, but they have been

gradually expanded to include articles of equipment, such as instruments and power plant parts, processes of manufacture, and design requirements. Of particular interest among recent developments is an agreement reached by the services to prepare a standard design handbook. It will be some time before this publication will be available; nevertheless, work is proceeding rapidly in preparation of the data to be incorporated therein.

A preliminary conference is held annually at which representatives of the Air Corps and the Bureau of Aeronautics discuss and agree on subjects for standardization and on the necessity for refining existing aeronautical standards. Work on preparing new standards and on revising existing ones is undertaken and, when completed, is referred to interested manufacturers for comment. A general conference is held as soon as practicable after the preliminary conference at which representatives of the industry are invited to be present and to submit their comment on the various standards proposed. In bringing into conference the experts who specialize in the manufacture of the various materials and products employed, the best and most suitable grade of the output of each basic industry is made available for both military and commercial aircraft use. Some of the more important items of standardization are listed below:

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|---|---------------------------|
| Acceptance test of aircraft engines. | Hose, gasoline. |
| Airspeed indicators. | Hubs, propeller. |
| Altimeter. | Inclinometer. |
| Aluminum alloy forgings. | Indicator, turn. |
| Aluminum and aluminum alloy, tubing, sheet, rods, and bars. | Induction compass. |
| Aluminum and aluminum alloy rivets. | Jackets, leather. |
| Batteries, aircraft. | Luminous material. |
| Bolts, hexagon, head, aircraft. | Oil pressure gauge. |
| Cable, high tension ignition. | Propellers, metal. |
| Cable, low tension, aircraft. | Pulley, control. |
| Chrome-vanadium steel. | Suit, summer flying. |
| Crating airplanes. | Tie rods. |
| Dope, aircraft. | Tubing, copper, seamless. |
| Electric heater. | Tires, airplane. |
| Gauge, fuel quantity. | Tubes, inner. |
| Generator, radio. | Webbing, linen. |
| Helmets, summer. | Weight forms. |
| | Welding procedure. |
| | Wheels, landing. |

The Bureau of Aeronautics is particularly active in the research and development of aircraft materials, and in this connection cooperates closely with the following organizations:

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| American Standards Association. | National Advisory Committee for Aeronautics. |
| American Society for Testing Materials. | Society of Automotive Engineers. |
| Federal Specifications Board. | |

BUREAU OF CONSTRUCTION AND REPAIR

This bureau has been actively engaged in the work of research and standardization, and in the development of new specifications. It is represented on the following organizations:

Federal Specifications Board: 38 committees and 15 subcommittees.
 American Standards Association: 3 administrative committees and 13 sectional committees.

American Society for Testing Materials: 12 main committees and 21 subcommittees.

American Marine Standards Committee: 5 main committees and 8 subcommittees.

Federal Purchasing Board, committee on commodities: 1 subcommittee and 12 advisory groups.

In its standardization and research activities the bureau cooperates with the following organizations:

Fine Arts Commission.

Bureau of Standards, division of simplified practice.

Bureau of Standards, commercial standards unit.

National Screw Thread Commission.

National Lumber Manufacturers Association.

Hemp Brokers Association.

Cordage Institute.

During the past year, 9 new Navy Department specifications and 50 revisions of existing specifications have been issued. In the development of Federal specifications the Bureau of Construction and Repair has been especially active in collecting data on metals, laundry machinery, abrasives and polishing materials, brushes and brooms, refrigerators, beds and bunks, textiles, rubber, and cordage.

In addition to a large number of minor laboratory investigations and reports, 115 principal research tests have been completed.

Marked research developments and improvements have been made in connection with the following materials:

Periscope tubes.

Tools.

Bullet proof steel.

Corrosion resisting wire rope.

Corrosion resisting steel gasoline tanks.

Bed spreads.

Curled hair woven on burlap (heat insulation).

Protective coatings.

Some of the principal investigations under way cover:

Aluminum furniture.

High elastic limit steel.

Welding.

Corrosion resisting steel.

Corrosion of rivets.

Corrosion of pipe.

Standardization of corrosion tests.

Copper bearing steel (sea water immersion).

New paint formulas.

Rubber gasket material.

Nonscatterable glass.

Manila rope.

Tools.

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 19 sectional committees.

American Society for Testing Materials: 16 committees and 31 subcommittees.

American Society of Mechanical Engineers: 12 sectional committees.
American Marine Standards Committee: Executive board and 13 committees.
National Screw Thread Commission.
American Gage Design Committee.
American Institute of Electrical Engineers: 2 committees.
American Institute of Radio Engineers: 1 committee.
American National Committee of the International Electrotechnical Commission.
National Electric Light Association: 2 committees.
Federal Technical and Scientific Board.
Advisory Committee on Nonferrous Metals of the Bureau of Standards.
Chief Coordinator's Committee on communication, purchase, supply, etc.
Interdepartmental Radio Advisory Committee.

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 been continual from previous years, in others investigation has just been inaugurated. Typical examples are as follows:

Electrical measuring instruments for shipboard use.
Electric cable for shipboard use.
Electrical equipment for metal arc welding.
Carbon-brush material.
Lighting-circuit voltages.
Incandescent electric lamps for shipboard use.
Electrical-insulating material (solid and liquid).
Electric machinery temperature gradients.
Lead-acid radio B batteries.
Dry batteries.
Portable lead acid batteries.
Electric heaters, air, for shipboard use.
Electric heaters, radiant.
Hard fiber for instrument board use.
Cotton sleeving insulating material.
Asbestos, linen, and silk insulating tapes.
Commutator conditioning devices.
Portable electric drills.
Motors and controllers (direct current).
Insulating varnish.
Portable electric ventilating sets.
Sound motion-picture projectors for shipboard use.
Outboard gasoline engines.
Fireroom draft gages.
Water meters.
Fuel oil meters.
Pump governors.
Temperature regulators.
Vacuum traps.
Propeller-type forced-draft blower.
Hard-rubber jars for submarine storage batteries.
Electric telegraphs (alternating current) for shipboard use.
Antinoise telephones for shipboard use.
Storage battery testing outfits.
Radio high-frequency receivers and transmitters.
Radio wave propagation.
Materials having piezo-electric effects.
Instruments for measuring high frequencies.
Radio traps.
Devices for measuring and recording the direction of static.
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.
Tachometers, chronometric 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 about 1,500° F.
Autogenous welding in the fabrication of engineering apparatus.
Antiseize compound for use in threaded aluminum and aluminum alloy parts.
Copper-nickel alloy condenser tubes.
Spring material for Diesel engine valves.
Boiler feed water treatment.
Chromium plating in naval use.
Centrifugally cast-iron liners for large air pumps.
Corrosion fatigue of metals.
Gasket material.
Packing.
Tool steels.
Cutting oils.
Lubricating oils.
Boiler refractories:
 Fire-clay brick.
 Fire-clay dust.
 Plastic fire-brick material.
 High-temperature cement.
 Diatomaceous earth insulating block.
Spark plugs.
Grinding compounds.
Gauge glasses.
CO₂ indicating instruments.
Brushes for motor-driven boiler-tube cleaning outfit.
Shafts for motor-driven boiler-tube cleaning outfit.
Fuel oil.
Diesel fuel oil.
Storage batteries, reduction in water consumption.
Storage battery explosions—investigation of causes.
Storage battery ventilation—hydrogen detector.
Strengths 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 gauges.

BUREAU OF MEDICINE AND SURGERY

The Bureau of Medicine and Surgery has representatives on several technical committees of the Federal Specifications Board and through them takes an active part in the plans and specifications for standardization, particularly of hospital supplies and equipment.

At the Naval Medical Supply Depot, Brooklyn, N. Y., all medical supplies and equipment, and X-ray apparatus used by the Navy

are carefully tested to determine their conformity to specifications. Much material used by the Veterans' Bureau and the Indian Medical Service is also examined in the testing laboratory of the Supply Depot.

BUREAU OF NAVIGATION

The Naval Observatory, under the jurisdiction of this bureau, is the source of standard of time in the United States.

The Naval Observatory has representation on the National Committee on Calendar Simplification and on several international commissions of the International Astronomical Union. The observatory investigated several subjects in its field with a view toward improving the character of work or materials, by means of new and modified specifications, operating instructions, or detailed reports.

The Hydrographic Office of this bureau works on specialized standardization between other branches of the Government under authority of Executive Order, September 30, 1919, which created the Board of Surveys and Maps. This office maintains membership in this board for the purpose of coordination and standardization of its chart and map construction.

The Hydrographic Office is represented on the United States Geographic Board for the purpose of standardizing names entering into its charts and publications; also cooperating with foreign hydrographic services. An International Hydrographic Bureau was established in 1921 for the purpose of standardizing and making uniform practices of hydrographic offices maintained by various nations. The United States is represented on this International Bureau.

The efforts of the Bureau of Navigation are directed toward 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 has membership in a number of technical committees of the Federal Specifications Board, and, in addition, is a member of the National Screw Thread Commission and the American Standards Association. Within the Navy Department itself, this bureau is a member of the departmental specifications board, which is continually at work on specifications, scrutinizing and revising as necessary Navy Department specifications now in existence, drawing up new specifications to conform to the needs of the various bureaus, and correlating department specifications with those of the Federal Specifications Board.

The work of this bureau during the past year, in the matter of standardizing specifications and practice, has developed logically along the lines followed in previous years. As Federal specifications have been promulgated, immediate steps have been taken to bring this bureau's specification requirements in conformance therewith. Many years of design and manufacture of ordnance equipment have brought into existence, in the bureau and its subsidiary plants, an extensive set of specifications for materials, as well as complete information, required for manufacturing purposes, relative to

material to be used, dimensions, fits, tolerances, finishes, etc. This information is carried on ordnance drawings and sketches, of which upward of 200,000 are now on file. The majority of these drawings bear notation referring to Navy Department specifications and Bureau of Ordnance manufacturing standards. Obviously, it is impossible with present drafting room forces to attempt, in addition to current work, a revision of such a mass of drawings, making them refer to a new set of specifications. With the cooperation of the Federal Specifications Board, permission was granted during the past year to print the Federal specifications in leaflet form, each bearing the old Navy Department specification number or symbol to which it corresponds or from which it has been taken. This serves immediately to connect ordnance drawings with the Federal specifications which properly apply to them.

In connection with design work, the Bureau of Ordnance maintains a list of standard stock parts which can be obtained commercially in large quantities and at a saving in cost. It is true that a large amount of material used in ordnance manufacture is, of necessity, special and noncommercial; but many stock fittings and parts find satisfactory use in ordnance, to the advantage of the Government. Design draftsmen are required to be familiar with Bureau of Ordnance standards and with the standard stock list, and to use material from this list where applicable and proper. National Screw Thread Commission standards for screw threads have been adopted. New design is in accordance therewith, while new manufacturing gages embodying these standards are, as fast as funds become available, being substituted for the old standards which were in use in previous years.

BUREAU OF SUPPLIES AND ACCOUNTS

Members of the bureau represent the Navy Department on a number of technical committees of the Federal Specifications Board, and the assistant chief of this bureau is the Navy Department representative thereon. Representatives are also assigned to the Federal Purchasing Board, Federal Traffic Board, and Federal Standard Stock Catalogue Board.

This bureau, during the fiscal year 1930, has issued 172 new and revised Navy Department specifications. Of this number, 53 of the new specifications are based on Federal specifications. In addition to the complete specifications, there were four issues of the Index to Specifications, also revisions of Appendixes II, III, and IV to General Specifications for Inspection of Material.

BUREAU OF YARDS AND DOCKS

Members of this bureau represent the Navy Department on 21 technical committees of the Federal Specification Board:

The bureau is also represented on advisory groups of four subcommittees of the committee on commodities of the Federal Purchasing Board.

The bureau also has membership on committees of the following organizations: Navy Department specification board, American Standards Association, and American Society for Testing Materials.

Long-time endurance tests of galvanized materials at the naval station, Key West, Fla., are being conducted by this bureau.

The bureau is conducting experiments to establish standards for concrete in sea water at the navy yard, Portsmouth, N. H., and at the Naval Operating Base, Hampton Roads, Va., the former for Portland cement and the latter for high alumina cement. Experiments are also being conducted on copper-bearing steel sheet piles and electroplated reinforcing bars at the naval station, Key West, Fla.

The bureau is also cooperating with the Chemical Warfare Service in field tests of timber preservatives, and is contributing funds for this work. The bureau is also conducting field tests of treated timber in connection with protection against termites.

During the past year the Design Data, Public Works of the Navy, was printed and distributed. The following standards were published or are now in preparation:

- 3Ya. Standards of Design for Concrete; new, printed.
- 4Yb. Concrete Pavements; revision, printed.
- 9Yc. Electric Apparatus—Distributing Systems and Wiring; revision, printed.
- 12Ya. Standards of Design for Structural Steel; Supplement No. 1, printed.
- 13Ya. Concrete Construction; new, printed.
- 14Ya. Electric Elevators and Dumb Waiters; new, printed.
- 16Ya. Refrigerating Equipment; new, printed.
- 17Ya. Piping Installation (hydraulic, fuel, air, heating); new, in preparation.
- 18Ya. Dredging; new, printed.
- 21Ya. Steel Welding (structural); new, in preparation.
- 22Ya. Mechanical Equipment, including installation; new, in preparation.
- 23Ya. Terrazzo; new, printed.
- 24Ya. Lathing, Plastering and Stucco; new, printed.
- 25Ya. Brick and Hollow-Tile Work; new, printed.
- 26Ya. Earthwork; new, printed.
- 27Ya. Screens (Doors, Windows and Porches); new, printed.
- 28Ya. Carpentry and Joinery; new, printed.
- 29Ya. Timber Work; new, being printed.
- 30Ya. Bituminous Pavements; new, in preparation.
- 31Ya. Plumbing, etc., new, being printed.
- 32Ya. Metal Doors and Trim; new, in preparation.
- 33Ya. Steel, Iron and Bronze Work; new, printed.

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, as far as practicable; 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 National 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, and one officer is detailed to full-time duty with the Federal Specifications Board, and is serving as vice chairman and technical secretary.

POST OFFICE DEPARTMENT

FOURTH ASSISTANT POSTMASTER GENERAL

Division of Equipment and Supplies

With the cooperation of the National Bureau of Standards, the department has improved its specifications for letter-box enamel which should prolong the life of this equipment and give it a better appearance.

Heretofore, malleable iron letter-box time-card frames have been used on letter-box equipment. It has been found that after a certain amount of rust develops there is a streaking of the letter-box time card. With a view to eliminating this condition the department has adopted time-card frames manufactured of brass in accordance with a formula furnished by the National Bureau of Standards.

For some time past, the department has been purchasing the ordinary commercial cash boxes for use in the Postal Service. In view of the number of such boxes used annually and the hard service they receive, a new specification has been drawn covering a more substantial type of box which will undoubtedly effect a considerable saving over the type previously furnished.

During the past fiscal year all official envelopes and various jackets supplied to the Postal Service were purchased from the several contractors under standard specifications. These specifications covered each item as to the quality of paper, substance, bursting strength, printing, packing, inspection, delivery, etc., and, in addition thereto, a drawing or blueprint specifically showing the size, style, gumming, and overlapping of seams of each item accompanied the advertisement. The prices obtained show no material changes over former years; however, the department has greatly benefited in that it procures stronger and more substantial envelopes.

Owing to the high prices that prevailed for mucilage made from pure gum acacia, at the time bids were opened on the department's annual proposal, and the fact that comparable practical results were obtained from a product containing a synthetic gum, all bids received were rejected and a new advertisement issued calling for mucilage made in the latter manner, in consequence of which a saving was effected. The specification used was one devised by the National Bureau of Standards several years ago when the use of synthetic gums by manufacturers was quite universal.

SECOND ASSISTANT POSTMASTER GENERAL

Railway Mail Service

The work of standardizing railway post office cars was continued during the year.

Two hundred and fifty new standard all-steel railway post office cars were built and placed in service during the year, and 50 addi-

tional all-steel cars are under construction. At the end of the year all full railway post office cars in actual service were of standard all-steel construction and all mail apartment cars in service were either of all-steel, steel underframe, or wood (steel reinforced) construction. There were only 29 wood mail apartment cars and these were held in reserve by the railroad companies and used only in emergencies. During the year 62 cars were brought up to the required standards and 57 cars were strengthened as to construction and equipped with interior fixtures so as to more nearly meet required standards. Sanitary fixtures were installed in 74 cars and 246 cars were equipped with electric fans. One hundred and twenty-six cars were equipped with electric light, in lieu of gas or oil lights, during the year. The railroad companies continue to cooperate with the Post Office Department in the work of standardizing mail cars and satisfactory progress in this work was made during the year.

The work of standardizing quarters occupied by terminal railway post offices located at or in railroad stations was continued during the year and at several points new quarters were obtained in modern buildings of fireproof construction and the quarters occupied by the terminal railway post offices were equipped with standard heating and lighting fixtures, toilet facilities, and ventilation.

TREASURY DEPARTMENT

COAST GUARD

The Coast Guard is represented on several of the Federal Specifications Board technical committees, and is especially interested in the development of standard specifications and standard articles for use on vessels and at shore stations. During the past year, efforts have been continued toward the standardization of boat equipment, boat davits, and the handling facilities. In the construction of several new vessels, an opportunity has been presented for the approval of a considerable amount of material made in accordance with Federal specifications or certified to meet the requirements of such specifications. When material meeting Federal specifications is furnished to the Coast Guard, it is considered standard equipment. Interchangeability of parts is required for competitive replacements.

DIRECTOR OF THE MINT

The Director of the Mint represents the Treasury Department on the technical committee on refractories of the Federal Specifications Board.

Gold and silver domestic coins are examined and tested by the assayer of the Bureau of the Mint to determine whether they conform to the legal standards as to weight and fineness. Tests of gold and silver alloys are made for other Government departments to check samples submitted and deliveries made to them on contracts based on specifications.

Assay commissioners designated by the President meet annually at the Philadelphia Mint and examine and test the gold and silver coins executed and reserved by the several mints for the purpose of securing a due conformity to the respective standards of fineness and weight.

Among the investigations in which the bureau laboratory is especially active are the preparation of proof gold and proof silver for use as standards in assaying.

OFFICE OF SUPERVISING ARCHITECT

This office has representatives on several technical committees of the Federal Specifications Board.

Standard miscellaneous drawings used in building construction have been revised to date, and the use of standard types of plans for certain buildings modified and adapted to suit various conditions have been continued.

The use of standard specifications for materials not yet covered by Federal specifications has been continued.

OFFICE OF THE TREASURER OF THE UNITED STATES

This office has taken no active part in the standardizing or specification making work, but it has cooperated to the fullest extent with the various Federal agencies in these activities.

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 Bureau of the Public Health Service is represented on the sectional committee of the American Standards Association for the development of an industrial sanitary code, and is sponsor for the project. The third draft of the code has been completed and has been tentatively submitted to the association. With the assistance of the association a new committee has been formed to consider the present draft and to suggest necessary changes both in its general construction and as to its field of application. It is also represented on a further sectional committee of the same organization for the revision of the previously adopted code of lighting of factories, mills, and other work places, sponsored by the Illuminating Engineering Society. A review of the rules and regulations at present prevailing in the lighting of school buildings in the United States has been published in the Public Health Reports (reprint No. 1261).

In cooperation with the National Safety Council a considerable portion of the year has been spent in making studies of the sand-blasting industry for the purpose of providing standards of allowable dustiness for this industrial process. Further studies of the practical efficiency of ventilating devices in various types of industries are being continued, each study having in view the obtaining of sufficient data to allow tentative standards of air velocities which will control the dust or fume hazard in the particular dust process.

In connection with the public health control of milk supplies, the standardization work of the Public Health Service has included the issue of the 1929 edition of the Standard Milk Ordinance and Code. This new edition embodies suggestions received from various public health and dairy organizations since the issue of the 1927 edition, which have been approved by the Public Health Service. The Standard Milk Ordinance and Code represents an endeavor to standardize so far as possible, and on a purely voluntary basis, the milk control work of the various States and cities. The number of cities which have thus far adopted the standard milk ordinance is 379. They are located in 22 States.

A representative of the Public Health Service is serving as a member of the Federal Standard Stock Catalogue Board. Representatives of the Public Health Service are serving on various committees for the preparation and revision of Federal specifications.

During the past 10 years the Public Health Service has been evolving means and methods of eliminating rat harborage on ship-board, and during the past year collaborated with the American Marine Standards Committee in the preparation of American Marine Standard H-41 which contains specifications for the rat proofing of maritime vessels.

WAR DEPARTMENT

Military Standardization.—All items of equipment peculiarly military are subjected to the following procedure before standardization:

The military requirements of an item having been set up by the using services are coordinated by the general staff and developed by the proper supply branch. When the article proposed for adoption as an item of military equipment has passed the experimental stage, it is passed on by the using arm or service, usually by a service test of the article, and then recommended for adoption as standard. It is then considered by the technical committee of that service which has had charge of the development of the article. This committee consists of representatives of the interested supply service and a representative from each of the other arms and services. It is possible that a need for the article under consideration exists in arms or services other than the one which recommended it for standardization. It is a function of this committee to determine if and where such need exists and as far as possible to adapt the article accordingly. Following favorable action by the technical committee, the application for standardization is forwarded to the Assistant Secretary of War. The Assistant Secretary of War determines whether the components of the article as well as the article itself can be procured in sufficient quantities to meet military requirements in time of war. If so, he clears this item for procurement. The application is then passed to the supply division of the War Department General Staff. It is then processed by the supply division through other interested divisions of the General Staff where any remaining differences are adjusted, then finally recommended to the Secretary of War for standardization.

The standardization of an item does not serve to stop further development; the desire to obtain perfection should not delay the standardization of at least one item for every military requirement

so that, in case of emergency, the procurement plan of each supply branch may be promptly launched. Items of equipment are classified as follows:

"Standard articles" are the most advanced and satisfactory that have been adopted and are those which are preferred for procurement to meet supply demands not met by the issue of available adopted types.

"Substitute standard articles" do not meet requirements so well as standard articles, but are usable substitutes for standard articles and would, when necessary, be procured to supplement the supply of standard articles.

"Limited standard articles" do not meet requirements so well as standard articles; nevertheless they are suitable for military use and are either in use or are available for issue to meet supply demands. Such articles will not be reproduced for the purpose of issue.

"Obsolete articles" are items of equipment and supply remaining on hand that have been designated by the War Department as unsuitable for further military use.

During the past year 45 important items of military equipment have been standardized.

Commercial Standardization.—In its standardization work other than purely military, the War Department is directly associated with the work of the Federal Specifications Board, the American Standards Association, the division of simplified practice of the National Bureau of Standards, the International Electrotechnical Commission, and the National Screw Thread Commission, and cooperates with a large number of engineering societies and trade associations.

The department is interested in industrial standardization in two ways—first as a large purchaser of supplies it is concerned with an extraordinary large range of specifications for materials and apparatus; second, in research work it is in contact with innumerable problems which are being actively studied in the commercial world. Direct contact with this work is maintained by the office of the Assistant Secretary of War.

Federal Specifications Board.—The supply branches of the Army have 113 members who represent the War Department on a number of technical committees of the Federal Specifications Board. Federal specifications form the basis of all related specifications prepared by the War Department. 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 standards council by a member detailed from the office of the Assistant Secretary of War and an alternate from one of the supply services in New York City, at present the Corps of Engineers. The department is represented on 31 sectional committees of the association. This representation is divided among the various supply branches.

Division of Simplified Practice.—The War Department participates constructively in the work of the division of simplified practice of the National Bureau of Standards. Active liaison is maintained with the division through the office of the Assistant Secretary of War. As each project is outlined and submitted, it is assigned for study and participation to the supply branch most closely interested, and the department is thereby represented at all conferences involving its activities.

National Screw Thread Commission.—Two members of the Ordnance Department represent the War Department on the National Screw Thread Commission.

The department is represented (Watertown Arsenal) on the joint committee on investigation of the effect of phosphorus and sulphur in steel.

International Electrotechnical Commission.—The War Department is represented on the United States National Committee of the International Electrotechnical Commission.

Present Status of War Department Standardization and Results Accomplished during 1930.—**QUARTERMASTER CORPS.**—Approximately 150 new and revised specifications were prepared and approved during the year. While numerous projects were in course of development and standardization, none were completed during the year.

Ordnance Department.—Forty-eight new and revised specifications were prepared. The metallurgical laboratory of the Ordnance Department has done considerable work during the past year in standardizing etching reagents for macroscopic and microscopic examination of metals, and has completed this project. The work of inspecting castings and other large structures for internal defects by means of X-ray examination has been continued with excellent results. The development of a high-speed tool steel wherein molybdenum is substituted for the strategic material tungsten has been completed and tools of various types are now undergoing an exhaustive test in Government arsenals. Suitable gun steels without nickel content have been developed and tested. Manufacture of gun carriages by welded construction has been adopted.

Corps of Engineers.—The civil engineering activities of the Corps of Engineers bring this service in close contact with the industrial work of the Nation and cooperation is continuously and actively carried on by the Board of Engineer Equipment, Fort Humphreys, Va., the various district engineer offices, and the supervising office in Washington. Thirty-one new specifications were adopted during the year.

There were several outstanding achievements by the Corps of Engineers as a result of studies, research and development, and tests covering the following commodities:

Construction Plant, Mobile.—In the interest of economy, this is a new development, which combines the development of a truck crane and pile driver into a mobile construction plant; that is, adaptable to military needs. The plant consists of the following components:

A 6-ton truck crane mounted integrally on a reinforced 5½-ton truck equipped with a detachable Christie crawler attachment; air compressor unit; air pile hammer; one-half-yard clamshell digging, and one-half-yard dragline buckets; and a supply of pneumatic hand tools and air hose.

Exploder, 10-cap capacity.—A new development of a small magneto exploder that is capable of firing 30 caps when properly wired together. The 10-cap exploder is practically waterproof and of approved electrical design. It is a suitable substitute for the 30-cap capacity magneto exploder which is now in use by the Corps of Engineers, and by reason of the small exploder's size and weight will result in reducing the cubage 93 per cent and weight of 82 per cent below that of the 30-cap exploder.

Generator Set, 5 kw.—In this particular case the Corps of Engineers has been using a 5-kw generator set that was of special design and weighed approximately 2,300 pounds, which was excessive. The new development covers a 5-kw generator set of commercial design. The weight is reduced to 745 pounds on skids, plus 94 pounds for the tools in a box and spares in a box, totaling approximately 819 pounds for the complete set. Tests have proved that the capacity of the set after continuous use and its ruggedness, which are the main points, cover the requirements as a satisfactory portable set for military use.

Strategic Raw Materials.—By reason of further studies conducted on this subject the emergency requirements on two materials reduced as follows: Ferro-manganese (80 per cent minimum) from 48,791 to 17,720 long tons; and wool, from 3,085 to 3.19 short tons.

Medical Corps.—Seventy-nine specifications covering items of medical and hospital supply were completed and approved, bringing the available number of specifications up to a total of 747, which cover 1,133 items, or about one-third of the expected total. During the year 76 specifications have been canceled.

The Medical Department maintains close contact with all other medical services and with governmental and commercial standardization agencies. The following list shows some of these commercial agencies:

- American Standards Association.
- The American Chemical Society for Reagent Chemicals.
- Commission on Standardization of Biological Stains.
- Committee of Scientific Apparatus Makers of America.
- The Cotton Textile Institute.
- The American Rubber Association.
- The American Society for Testing Materials.

Signal Corps.—Rapid advance in the art of communication and in the science of related equipment involves a continuous change in matériel, in which work some of the best talent of the country is constantly engaged. The Signal Corps is in the forefront of this work both on a cooperative basis with the general industrial and engineering movement and in its own laboratory and experimental testing. Much of its work originated for Army use has developed commercial significance and has been released for the general advancement of the art. It is the general policy of the Signal Corps not to adopt any specification until it has proved its value and has been passed upon by industry; thus complete standardization from research laboratory through the manufacturer to the user is assured. Outstanding in the Signal Corps is the continuing work being done on the wires used in the field by communication troop.

Air Corps.—The specification activities of the Air Corps are confined to equipment and materials used in military aircraft. The present program of the Air Corps includes studies and conferences for the purpose of standardization of additional items and co-ordination of design and material requirements of the Army-Navy aeronautical activities for equipment common to both services. During the past year 100 new standard specifications have been promulgated and 38 standard specifications revised.

In a recent Army-Navy standards conference which was attended by approximately 200 representative aircraft and aircraft accessory manufacturers, 63 specifications and certificates covering requirements of aeronautical equipment and materials were approved. Standard specifications and drawings are being prepared to incorporate the recommendations as set forth in the minutes of the recent Army-Navy conference.

Standardization of design requirements for aircraft equipment and materials which are not subject to regular specification procedure are acknowledged by certificates. These certificates are approved by both the Army and Navy and the certified requirements are incorporated in drawings and specifications where applicable.

In addition to the preparation of standard specifications for the Air Corps and standardization of requirements between the Army and Navy, the Air Corps cooperates with the Society of Automotive Engineers, American Society of Mechanical Engineers, and the Tire and Rim Association in establishing standards for aircraft equipment and materials for commercial use.

CHEMICAL WARFARE SERVICE.—The Chemical Warfare Service has placed special emphasis on the preparation of specifications and the standardization of manufacturing processes during the fiscal year 1930. Seventy-two new specifications were written and 14 were revised. All specifications have been cleared through industry and commercial practices involving quantity production are incorporated in all specifications.

In connection with the manufacture of matériel at Edgewood Arsenal, all procedures have been standardized and process directives prepared.

COAST ARTILLERY CORPS.—Specification activities of the Coast Artillery Corps are limited to equipment and matériels for controlled submarine mines, about half of which have now been completed.

BUREAU OF INSULAR AFFAIRS.—The Bureau of Insular Affairs is the agency through which the insular governments of the Philippines and Porto Rico secure the services of the various standardization and specification making agencies of the United States Government. Since 1918 this bureau has maintained direct liaison with the National Bureau of Standards in regard to matters of interest to the insular governments. The bureau also procures standard specifications from manufacturers in the United States for distribution to the government offices of both the Philippines and Porto Rico. The items on which information of this nature has been obtained embrace a wide range of raw matériels and manufactured articles.

INDEPENDENT ESTABLISHMENTS

BOARD OF SURVEYS AND MAPS OF THE FEDERAL GOVERNMENT

The board approved a joint report of the committees on hydrographic charts and technical standards. In this report consideration was given to recommendations of the International Hydrographic Conference for symbols to be used on nautical charts. These standard symbols are recommended for adoption by the member States of the International Hydrographic Bureau.

The following recommendations were approved:

Coloring of light sectors; reference to adjoining charts; standardization of the titles of charts; standardization of the dating of charts; dimensions of charts; scale of charts; insertion of meridians and parallels on charts; indication on charts of the direction of buoyage of channels; method of insertion of echo soundings on charts; nautical information concerning canals for inland navigation.

The symbols for ice limit, any kind of station, and dredged channels have been modified.

Standard symbols have now been approved by the board for: Rock awash; telegraph cable; leader cable; observation spot; ferry; temple, pagoda; mosque, minaret; marabout; windmill; water mill; fort; battery; dry dock; patent slip; floating dock; leading line; course or channel recommended; ice limit; any kind of station (the position of which has been fixed), including semaphore, signal, and telegraph stations; fish weir; fixed beacon; floating beacon; light beacon; light buoy; chimney, tower; bench mark; wireless stations; sunken rocks; conventions for wrecks; compulsory seaplane anchorages on marine charts, and for various limits, such as fishing zones, air ports, and maritime limits in general.

FEDERAL RADIO COMMISSION

The duties of this commission are the regulation of all wireless communication activities, including broadcasting, ship, amateur, and point-to-point services within the jurisdiction of the United States; the issuance of all licenses and the allocation of frequencies, etc., for the purpose of bringing about clearer and better transmission and reception.

The commission issued General Order No. 91, and adopted General Order No. 92 during the past year.

FEDERAL TRADE COMMISSION

The Federal Trade Commission contributes to standardization chiefly through its trade practice conferences. It sponsors gatherings of a number of representatives of a given industry for consideration of unfair methods of competition. At the conference an industry usually adopts a set of business principles condemning unfair practices common among its members, and thenceforth these standards, providing they have been submitted to the commission for approval and have been acted upon, serve as guides to such an industry.

Conferences have been held in the last four years for close to 125 industries.

GENERAL ACCOUNTING OFFICE

Motor Fuels Tax Exemption Forms.—In cooperation with the Bureau of the Budget and the Chief Coordinator the General Accounting Office was able to secure the adoption and promulgation of the following standard forms in connection with the procurement of motor fuels, lubricants, and antifreeze liquids for the purpose of securing the exemption of all Federal activities from the payment of State or local tax thereon:

Standard Form 44, United States Government motor fuels tax exemption certificate.

Standard Form 45, United States Government motor fuels tax exemption identification card.

Standard Form 1066, United States Government motor fuels tax exemption receipt.

Each Government officer or employee seeking to procure gasoline or other taxable motor fuel, etc., for official use will be suitably identified by means of an identification card (Form 45) which will be officially furnished him for the purpose.

The certificate (Form 44) will be given in each case to the dealer or contractor for the purpose of evidencing the noncollection of tax on the materials furnished for official use of the Government.

Form 1066, which will be prepared simultaneously with Form 44, constitutes the record of the purchase of motor fuels, etc., and furnishes the retained evidence in case of each purchase that payment was made at the net rate; that is, without the imposition of State or local tax. The form will also serve the purpose of a receipt for payments made by Government employees for motor fuels, etc., procured and used in connection with authorized travel, for which reimbursement is sought on an actual expense basis.

Index to Decisions of the Accounting Officers.—This office compiled and sent to the Public Printer for printing and binding in one volume an "Index to the Published Decisions of the Accounting Officers, with statutes, decisions, and opinions cited therein (also cross references), 1894-1929." Part 1 of the index comprises a consolidated index by subjects to the decisions included in the published decisions of the Comptroller of the Treasury from 1894 to June 30, 1921, and of the Comptroller General of the United States from July 1, 1921, to June 30, 1929. Part 2 contains a consolidation and tabulation of statutes cited in decisions covering the same period; by referring to this part of the index, references may be immediately secured to decisions rendered in connection with the provisions of a particular statute. Part 3 contains similar references with respect to decisions of the accounting officers and the courts and of the opinions of the Attorney General.

Progress in Uniform Accounting.—The progress made by the General Accounting Office in the standardization of fiscal and administrative accounting records and procedures, and toward the ultimate goal of uniformity in and standardization of all Federal accounting, is briefly reviewed as follows:

1. Classification has been made, for budgetary and other purposes, of all governmental expenditures by objects. (Bulletin No. 1, and Supplements Nos. 1, 2, and 3, General Accounting Office.)

2. There has been developed and promulgated a uniform system for administrative appropriation and fund accounting. Provision has been made for the development of cost accounting, and, in several instances, the General Accounting Office has cooperated with the administrative offices in preparing proper accounts for cost purposes. A cursory survey shows that the system has been installed—in whole or in part—in approximately 40 per cent of all the bureaus of the Government. Some departments and establishments have not installed it, while it is in operation in a number of establishments and in many bureaus and divisions of certain departments. (Circular No. 27, General Accounting Office.)

3. An accounting system for disbursing offices has been prepared and installations have been made in a number of offices in Washington and the field.

4. Procedures for receiving, disposing of, and accounting for remittances received by administrative offices, for scheduling and summarizing disbursement vouchers, for adjusting charges between appropriations of the several departments and establishments, and between appropriations of bureaus and offices within a department, have been standardized and prescribed. (General Regulations Nos. 21, and Supplement No. 1; 40, and Supplement No. 1; and 72, General Accounting Office.)

5. Standard forms—applicable to all offices—have been prescribed for accounts current, pay rolls, schedules of collections, schedules of disbursements, requisitions for funds, public vouchers for services other than personal, for reimbursement of travel expenses and for advertising, and for special and regular salary receipts. (General Regulations Nos. 34, and Supplements Nos. 1, 2, 3, and 4; 36, and Supplements Nos. 1 and 2; 41; 43, and Supplements Nos. 1 and 2; 51, and Supplements Nos. 1, 2, and 3; 60; and 66, and Supplement No. 1, General Accounting Office.)

6. Provision has been made for the consolidation of separate special deposit and regular accounts, thereby reducing the number of accounts to be prepared and forwarded to this office for settlement, and reducing also the number of disbursing accounts on the books of the Treasurer of the United States. (General Regulations No. 71, General Accounting Office.)

7. The symbolization of all receipt accounts, and all appropriation, special, and trust fund accounts, has been effected, facilitating the making of entries in the records and insuring greater accuracy, especially where bookkeeping machines are used. (General Regulations Nos. 44 and 67, General Accounting Office.)

8. A procedure for accounting for deductions from salaries of employees for the civil-service retirement and disability fund, and for ascertaining the liability of the United States, has been prescribed. (General Regulations Nos. 54, and Supplement Nos. 1 and 2; 65, and Supplement No. 1, General Accounting Office.)

9. A uniform procedure has been prescribed for obtaining advances of public funds by Federal employees under the provisions of the subsistence expense act of 1926. (General Regulations No. 59, and Supplement No. 1, General Accounting Office.)

10. General Accounting Office requirements were prescribed for the allocation of funds by one department or establishment to another. (Circular No. 22, General Accounting Office.)

11. Prior to 1921 the handling of Government checks and warrants differed widely in the various offices of the auditors. For the better control of such important papers a procedure for proving out promptly disbursing accounts was established, and, from time to time, directions were issued for the proper safeguarding, negotiation, etc., of checks and warrants. (General Regulations Nos. 23, and Supplements Nos. 1 and 2; 31, and Supplement No. 1; and 61; Bulletin No. 3 and Supplements Nos. 1 and 4, General Accounting Office.)

12. For the purpose of providing an orderly procedure for the settlement of claims against the United States, rules applicable to all claims were prescribed for their submission to this office and for the action of all departments and establishments in connection therewith. (General Regulations Nos. 42, and Supplements Nos. 1 and 2; and 50; Circular No. 21, General Accounting Office.)

The standardization of accounting forms and procedures assists in a marked degree in improving methods of accounting. Accounting forms and procedures are prescribed, revised, consolidated or canceled, thereby securing improvement in the accounting system, and at the same time permitting a reduction in the number of forms required and resulting in the destruction of Government Printing Office plates thereby made useless.

GOVERNMENT PRINTING OFFICE

The Government Printing Office maintains a technical division for the purpose of inspecting and testing all materials offered and delivered for the use of the office; to prepare or assist in the preparation of specifications for the purchase of materials; to maintain technical control over the quality and production of 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 used by the office.

By the act of May 14, 1928, Congress authorized the Government Printing Office to engage in cooperative research work 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 the intensive study under the supervision of the technical director of problems approved by the Public Printer. The laboratory facilities and equipment of the Government Printing Office are available for such research work.

The results of the 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 at the Government Printing Office, one, representing the mechanical section of the American Newspaper Publishers Association, is working on newsprint paper and news inks; the other, representing the Employing Bookbinders of America, is working on bookbinding materials.

The following is an outline showing the scope of the technical work 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 Typothetae of America.

National Association of Glue Manufacturers.

Technical association of the Pulp and Paper Industry.

Paper manufacturers.

Type metal supply companies.

Bookbinding leather manufacturers.

Individual printing, binding, and allied manufacturers.

The Public Printer is a member of the standardization committee of the United Typothetae of America and the research and survey committee for the printing industries division of the American Society of Mechanical Engineers.

The Government Printing Office 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 Government Printing Office has three representatives on the paper specifications committee appointed by the 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.

INLAND WATERWAYS CORPORATION

During the past year the Inland Waterways Corporation has developed standard barges capable of operating with a certain load on a 6-foot channel and double that load on a 9-foot channel, standard towboats for operating upon a channel depth of 4 to 6 feet, one for operating on a channel depth of 6 to 8 feet, and one for operating upon a channel of 8 feet deep or greater.

In addition, standard terminals have been developed for the interchange of freight between rail and water carriers and standard divisions of accruing revenue between participating rail and water carriers have been established.

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Standardization of Method of Analysis of Aircraft Accidents.—

During the past year the National Advisory Committee for Aeronautics, through its committee on aircraft accidents, has revised its report on Aircraft Accidents—Method of Analysis, and published the revision as Technical Report No. 357. The committee which prepared this revision includes in its membership representatives of the air organizations of the Army, Navy, and Department of Commerce. The report, which was prepared in its original form in 1928 by a special subcommittee organized in response to the need for a satisfactory basis for the classification and comparison of aircraft accidents in various organizations, presents a standard method of accident analysis which is now in official use in the War, Navy, and Commerce Departments.

This standard method provides for the analysis of aircraft accidents from the point of view of both personnel and matériel problems, and permits the analysis of a particular accident into two or more distinct causes, making possible, by the use of percentages, the indication of the relative weight of each cause. The system provides also for the analysis of crashes according to the nature of the accident (take-off accidents, tail spins following engine failure, etc.) and to the degree of seriousness of personnel injuries and amount of damage to matériel, and, in addition, by the use of a cross-analysis method, allows for the analysis of pilots' errors and matériel failures according to the underlying causes of these errors or failures. All these bases of analysis have been combined into a single chart, which is intended to be used in the study of each individual accident, and is accompanied by definitions and explanations as to its use.

The revised report includes the analysis chart as originally published, together with the definitions and explanations, a number of which have been clarified in the light of the experience gained in the classification of accidents according to the standard method, in the War, Navy, and Commerce Departments. The report contains also a brief summary of some of the statistical results obtained in this accident analysis.

The committee on aircraft accidents will continue its study of the problem, considering in particular information obtained from time to time in the analysis of accidents which appears to indicate the desirability of changes in existing features of aircraft operation or construction.

NATIONAL SCREW-THREAD COMMISSION

The activities of the commission during the year have been directed principally along lines calculated to bring the screw-thread standards established by the commission into wider and more effective use in industry. The latest report of the commission (Bureau of Standards Miscellaneous Publication No. 89), has been subdivided into three sections and republished as separate pamphlets covering: I. Standard Threads; II. Special Threads; and III. Plain and Thread Plug and Ring Gage Blanks. These are intended primarily for shop use. They have also been submitted to industry, through the division of trade standards, of the bureau, for acceptance as commercial standards.

The commission has continued to cooperate with the American Petroleum Institute, the Federal Specifications Board, and with sectional committees organized under the procedure of the American Standards Association.

Plans are now under way for the carrying out of a survey, in cooperation with the American Society of Mechanical Engineers, to determine the extent to which the commission's screw-thread standards are being followed in industry.

American Gage Design Committee (organized under the procedure of the A. S. A.).—The report of the American Gage Design Committee (Bureau of Standards Miscellaneous Publication No. 100), which was printed during the year, has met with wide acceptance and approval by manufacturers and users of limit gages. Its wide use has resulted in substantial savings in industry.

The conspicuous success of this committee indicates that it might well extend its activities to include additional sizes and types of limit gages.

OFFICE OF THE CHIEF COORDINATOR

During the year the office of the Chief Coordinator, with the assistance of the National Bureau of Standards, continued its efforts to secure standardization of telephone service and promote operating economy through the consolidation of private branch exchange telephone switchboards in Federal buildings outside the District of Columbia housing two or more Government activities. Field telephone traffic surveys were conducted and recommendations for consolidation made in a number of localities.

The program of concentration in one building of all Federal activities renting space in a given city was advanced by this office during the year. The expected advantages of this program have been realized wherever concentration has been effected and the project is being continued actively in several cities.

Recommendations to Government departments and establishments relative to the adoption of standard procedure in the storage and issue of Federal property were made by this office during the year. The general adoption within the Government service of these recommendations will produce a more economical administration of its supply functions with increased efficiency.

With a view to promoting the standardization of practice among the several Government activities having common operating prob-

lems, this office promulgated during the year circular letters of advice on the following subject:

Formula for polish, furniture, for varnish and paint coatings on wood.
Oil, lubricating, selecting for automotive equipment.
Ship bottom paints applied to Government vessels.

Federal Liquidation Board

The policies and plans formulated by the Federal Liquidation Board for the liquidation of surplus supplies and the coordination of sales throughout the several departments and establishments having been adopted and become routine, its function as a coordinating agency was no longer necessary and it was dissolved by direction of the President on November 15, 1929.

Federal Purchasing Board

The Federal Purchasing Board has standardized the practice of transferring materials and supplies between Federal departments and establishments, by adopting the uniform policy, wherever practicable, of adding a surcharge to the stock or issue price of articles so transferred. This surcharge is based on the actual (or estimated) cost of handling and any other incidental expenses, and does not include any arbitrary addition. If estimated, its accuracy is verified from time to time, and any necessary revision is made accordingly.

The board has also standardized the procurement of lumber, through the adoption of a uniform policy under which bids are solicited and considered for both grade-marked lumber and lumber covered by a certificate of grading, in addition to the usual plan of inviting and considering bids for lumber under ordinary conditions of inspection or grading. The policy includes the preferential consideration of bids for lumber of the categories mentioned, in the order named, when all other elements are equal or afford greater advantages.

There is also in process of standardization, by the board, a uniform policy to govern all Federal departments and establishments in the rejection of materials and supplies found upon inspection not to conform to specifications, and in the determination of price to be paid in event of use thereof nevertheless, in cases of emergency.

Federal Specifications Board

There have been promulgated the following new Federal specifications, during the past year:

F. S. No.

- 622a. Gasoline, Motor, United States Government.
- 623. Motor Fuel V.
- 624a. Asparagus, Canned.
- 625a. Beans, String, Canned.
- 626a. Beets, Canned.
- 627a. Corn, Canned.
- 628a. Peas, Canned.
- 629a. Pumpkin, Canned.
- 630a. Sauerkraut, Canned.

F. S. No.

- 631a. Spinach, Canned.
- 632a. Tomatoes, Canned.
- 633. Towels, Crash, Mixed Linen and Cotton.
- 634a. Fruits, Dried (Evaporated).
- 635a. Jams.
- 636a. Barley, Pearl.
- 637a. Biscuit.
- 638a. Cornmeal (White or Yellow).
- 639a. Cornstarch.

F. S. No.

- 640a. Crackers, Soda.
- 641a. Flour, Wheat.
- 642a. Flour, Buckwheat.
- 643a. Flour, Graham (Whole Wheat Meal).
- 644a. Tapioca.
- 645a. Hominy Grits and Hominy Grits, Coarse.
- 646a. Hominy, Lye, Canned.
- 647a. Rice.

F. S. No.

- 648a. Spaghetti, Macaroni and Vermicelli.
- 649b. Tea.
- 650b. Cocoa.
- 651b. Chocolate.
- FS. Symbol:
 - ZZ-T-391 Tires; Automobile, Solid.
 - ZZ-T-721 Tubes; Automobile and Motor Cycle, Inner.

The following specifications have been revised during the past year:

F. S. No.

- 107a. Packing, Semimetallic.
- 161b. Coffee.
- 215b. Aprons, Surgeons', Rubber.
- 216a. Bags, Ice, Helmet-Shaped.
- 220b. Bottles, Hot-Water, Cloth-Inserted.
- 221b. Bottles, Hot-Water, Rubber.
- 224a. Cots, Finger, Rubber.
- 226b. Cushions, Ring, Cloth-Inserted.
- 227b. Cushions, Ring, Rubber.
- 230b. Pads, Surgical Operating.
- 231a. Pillowcases, Rubber.
- 232b. Pillows, Air, Rubber.
- 233b. Sheeting, Rubber.
- 234b. Syringe, Fountain, Cloth-Inserted.
- 235b. Syringe, Fountain, Rubber.
- 242a. Pipe, Wrought-Iron, Uncoated and Zinc-Coated (Galvanized).
- 269a. Rods, Welding, Nonferrous, for Gas Welding.
- 317a. Oatmeal and Rolled Oats.
- 396a. Brushes, Calcimine.
- 397a. Brushes, Dust, Ceiling and Wall.
- 399b. Brushes, Flat Fitch.
- 400a. Sweep, Floor, Hair.
- 401b. Brushes, Glue, Round.
- 402a. Brushes, Glue, Flat.

F. S. No.

- 403a. Brushes, Lacquering, Flat.
- 404b. Brushes, Marking.
- 405a. Brushes, Mottling.
- 406b. Brushes, Sash Tool, Oval.
- 512a. Brushes, Flowing Badger Hair.
- 513a. Brushes, Flowing, Squirrel Tail Hair.
- 514a. Brushes, Flowing Skunk Hair.
- 515a. Brushes, Paint, Flat Metal Bound (High Grade).
- 516a. Brushes, Paint, Flat Metal Bound (Medium Grade).
- 517a. Brushes, Radiator Bronzing.
- 518a. Brushes, Roof, Knotted Style, Three Knots.
- 519a. Brushes, Stencil (Flag Ends Cut).
- 520a. Brushes, Stencil (Flag Ends Preserved).
- 521a. Brushes, Varnish, Flat (Triple X Thickness).
- 522a. Brushes, Varnish, Flat (Double X Thickness).
- 524b. Brushes, Whitewash.
- 525a. Dusters, Painters', Flat.
- 526a. Dusters, Painters', Round.
- 574b. Sausage, Frankfurter-Style.
- 576b. Sausage, Vienna-Style, Canned.

FS. Symbol:

- H-B-141. Brushes; Calcimine.
- H-B-241. Brushes; Fitch, Flat.
- HH-T-101. Tape; Friction.
- ZZ-R-601. Rubber-goods; general Specifications (Methods of Physical Tests and Chemical Analysis).

FS. Symbol—Continued.

- ZZ-T-381. Tires; Automobile, Pneumatic.
- ZZ-T-391. Tires; Automobile, solid.
- ZZ-T-721. Tubes; Automobile and Motor Cycle, Inner.

Federal Specification No. 185, General Service Bed, has been withdrawn, pending adoption of a revision.

Federal Specification No. 115, Titanium Pigment, Dry and Paste, has been canceled for the reason that the description of the commodity covered a patented article which can be secured only from one source.

Federal Specification No. 379, Colored Waterproof Drawing Ink, has been withdrawn pending further research and adoption of a revision.

The following Federal specifications for paper were canceled, and the respective specifications of the Joint Committee on Printing, as indicated on the opposite side of the table, were adopted for field services. No new issues of Federal specifications for paper will be issued:

| Specifications canceled | | Specifications adopted | |
|-------------------------|--|------------------------|---|
| U. S. G. M. Spec. No. | Title | Lot No. | Title |
| 127a | Paper, Blotting, 25 Per Cent Rag, White and Colored. | 356-357 | 25 Per Cent Rag Blotting, White and Colored. |
| 128a | Paper, Blotting, Desk, Colored. | 358-359 | Desk Blotting, Colored. |
| 129a | Paper, Chart. | 69 | 100 Per Cent Rag White Chart Paper, Lithograph-Finish, Tub-Size, Air-dried. |
| 130a | Paper, Mimeograph. | 43-44 | Chemical Wood Mimeograph, White and Colored. |
| 131a | Paper, Mimeograph, 50 Per Cent Rag. | 47 | 30 Per Cent Rag Mimeograph. |
| 132a | Paper, Wrapping, Wood Manila. | 209-210 | Wood Manila. |
| 133a | Paper, Wrapping, Rope, Manila. | 213-214 | Rope Manila. |
| 177a | Paper, Wrapping, Kraft. | 220 | Kraft. |
| 178a | Paper, Wrapping, Sulphite Manila. | 211-212 | Sulphite Manila. |
| 319 | Paper, Bond, 100 Per Cent Rag, White. | 128-129 | 100 Per Cent Rag White Bond, Tub-Sized, Air-Dried. |
| 320 | Paper, Bond, 50 Per Cent Rag, White and Colored. | 120-123, incl. | 50 Per Cent Rag Bond, White and Colored, Tub-Sized, Air-Dried. |
| 321 | Paper, Ledger, 100 Per Cent Rag, White. | 176-181, incl. | 100 Per Cent Rag White Ledger, Tub-Sized, Air-Dried, for Permanent Records. |
| 322 | Paper, Ledger, 75 Per Cent Rag, White and Colored. | 168-173, incl. | 75 Per Cent Rag Ledger, White and Colored, Tub-Sized, Air-Dried. |
| 323 | Paper, Manifold, 100 Per Cent Rag, White and Colored. | 78-81, incl. | 100 Per Cent Rag Manifold, White and Colored, Tub-Sized, Air-Dried. |
| 324 | Paper, Map, Lithograph-Finish. | 64 | Lithograph-Finish Map. |
| 325 | Paper, Map, 50 Per Cent Rag, Lithograph-Finish. | 65 | 50 Per Cent Rag Lithograph-Finish Map, Tub-Sized, Air-Dried. |
| 326 | Paper, Map, 75 Per Cent Rag, Lithograph-Finish. | 66-67 | 75 Per Cent Rag Lithograph-Finish Map, Tub-Sized, Air-Dried. |
| 327 | Paper, Blotting, White and Colored. | 354-355 | Blotting, White and Colored. |
| 328 | Paper, Bond, Sulphite, White and Colored. | 101-105, incl. | Sulphite Bond, White and Colored. |
| 329 | Paper, Writing, Sulphite, White and Colored. | 55-61, incl. | Sulphite Writing, White and Colored. |
| 330 | Paper, Ledger, 100 Per Cent Rag, Heavy, White. | 196 | 100 Per Cent Rag Index, White and Cream, Single-Ply, Tub-Sized, Air-Dried. |
| 331a | Paper, Manifold, 50 Per Cent Rag, White and Colored, Glazed. | 73-76, incl. | 50 Per Cent Rag Manifold, White and Colored. |
| 484a | Paper, Manifold, 50 Per Cent Rag, White and Colored, Unglazed. | 73-76, incl. | 50 Per Cent Rag Manifold, White and Colored. |

A somewhat revolutionary change has been effected as regards the revision of all Federal specifications adopted by the board, to include purchase requirements in accordance with a revised outline of form, which was adopted under date of December 3, 1929.

All Federal specifications will be printed in new form, through the Federal Standard Stock Catalogue Board. Federal specifications issued hereafter will bear symbols, and will adhere to standard nomenclature in accordance with those issued by the Federal Standard Stock Catalogue Board.

During the past year it was decided to broaden the specifications for provisions to include grades and classes for the mandatory use of all departments and establishments of the Government. In the past, such specifications have been mandatory only on the Army, Navy, and Marine Corps, and optional for the other branches of the Government.

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, and valuable data for inclusion

are being compiled by the Federal Specifications Board and the Federal Purchasing Board.

The Federal Standard Stock Catalogue Board was created by Bureau of the Budget Circular No. 260 of March 29, 1929, which provided that:

It shall be the duty of the Federal Standard Stock Catalogue Board to determine the articles to be included in the Federal Standard Stock Catalogue, together with information relative to nomenclature, descriptions, classifications, groups, specifications, stock numbers, code words, and other pertinent data, and to decide questions of arrangement and other considerations that may arise in connection with the compilation of the catalogue.

The Quartermaster General of the Army and the Paymaster General of the Navy have detailed civilian personnel to assist the board in the compilation of the catalogue.

Commercial and industrial establishments are exhibiting much interest in the Federal Standard Stock Catalogue and many requests for complete volumes have been received. It is believed that eventually this compilation will become a master catalogue for commercial and industrial business as well as for governmental business.

To June 30, 1930, the following sections and parts of the Federal Standard Stock Catalogue have been issued:

| Section | Part | Title | Section | Part | Title |
|---------|------|--|---------|------|--|
| I | | Title-page. Chief Coordinator's Bulletin. Chief Coordinator's Bulletins (revised). Preface. General Index of Federal Property (loose-leaf). | III | 1 | List of Groups for Procurement (alphabetical). |
| | | General Index of Federal Property (pamphlet, bound). | | 2 | Procurement Categories. |
| II | 1 | Classes for Storage and Issue. | IV | 3 | Simplified Practice Recommendations. |
| | 2 | Key to Department and Establishment Columns. | | 5 | American Marine Standards. |
| | 3 | Storage Notes and Stowage Precautions. | | 7 | Explanatory Notes, Groups for Procurement. |
| | 4 | Code for Numbers and Phrases. | | 1 | Index of Federal Specifications. |
| | 5 | Explanatory Notes. | | 4 | Paper Specifications. |
| | 6 | Class: 5, flags. 14, oils. 24, canvas. 27, dry goods. 28, blank forms. 31, lighting apparatus (nonelectric). 38, brooms; brushes. 44, pipe; tubes; tubing (nonflexible). 46, color designations for metals. | | 5 | Federal specification: H-B-141, Brushes; Calcimine. H-B-241, Brushes; Fitch, Flat. HH-T-101, Tape; Friction. ZZ-R-601, Rubber Goods: General specifications. (Methods of physical tests and chemical analyses.) ZZ-T-381, Tires; Automobile, Pneumatic. ZZ-T-391, Tires; Automobile, Solid. ZZ-T-721, Tubes; Automobile and Motor cycle, Inner. |

Federal Traffic Board

The Federal Traffic Board was created by Circular No. 41 of the Director of the Bureau of the Budget, dated October 10, 1921, and is composed of one representative from each of the major departments and independent establishments of the Government, who is designated by the head of that department or establishment. It has full authority, subject to review by the Chief Coordinator, to pass on all questions pertaining to: (a) Establishment of uniform classifications for all commodities shipped by the Government; (b) drafting of plans for improving and standardizing methods of making shipments and settlement of accounts; and (c) adjustment of all questions which require application of remedial measures, such as freight rates, switching and terminal charges, etc.

The board functions by means of committees appointed by the chairman, who is also the coordinator for traffic, and, as such, the operating head of the board. All movements of freight consisting of two carloads or more, from any Government department, are routed by the office of the coordinator for traffic, which undertakes to provide the most economical route for the shipment. The Federal Traffic Board meets monthly on the third Friday of each month, and, at that time, all questions are presented and assigned to the proper committee for study and recommendation.

The office of the coordinator for traffic has routed, for the past seven months of the current year, a total of 23,270 carloads of Government freight, or an average of 3,324 carloads per month.

Interdepartmental Board of Contracts and Adjustments

The contract board has been working upon a proposed revision of the standard Government contract forms and a proposed new public contract law known as H. R. 5568.

Interdepartmental Board on Simplified Office Procedure

Current Activities.—The board's general activities during the year consisted of the following:

Classifying, simplifying, and standardizing routine administrative functions common in two or more departments or establishments.

Developing standard forms to meet the needs of each routine administrative function common in two or more executive branches of the Government (General Accounting Office forms excepted).

Investigating and recommending for general use a publication now used by one department which furnishes information valuable to all departments in determining the shortest usually traveled route when figuring the payment of transportation vouchers of Government officials and employees traveling on a mileage basis.

Standardizing the use of office supplies, materials, and equipment.

Planning for the efficient and economical management of personnel.

Envelopes.—Investigation by the board, in conjunction with the envelope specifications committee, Post Office Department, of suggestions received from various departments disclosed a need for revision of several envelope items. Accordingly, the committee rewrote the envelope specifications and modernized the schedule from cover to cover. In its study this committee found that manila envelopes do not prove as satisfactory in service as kraft, because of the deterioration which comes to manila in storage. Accordingly, kraft has been substituted for manila in the Post Office Department schedule for envelopes for this fiscal year.

Standard Forms.—During this fiscal year the board has completed its work on the following forms which have been promulgated as standard:

United States Government motor fuels tax exemption certificate (standard Form No. 44), and United States Government motor fuels tax exemption identification card (standard Form No. 45).

Standard Personnel and Retirement Procedure.—After a careful and far-reaching investigation an outline of a proposed standard personnel and retirement procedure, prepared by a specially constituted committee of the board, was submitted to the departments

and establishments for comment. This proposed procedure is for the dual purpose of enabling the President, with the minimum of obstruction and delay, to impose a unified plan in the matter of Government routine personnel and retirement business, and to so coordinate personnel administration in the different departments and establishments as will insure the most economical and efficient expenditure of moneys by Congress for these purposes.

It was found, after making a study of the comments of Government activities regarding the proposed plan for standard personnel and retirement procedure, that the recommendations and conclusions of the committee in submitting its report to the Chief Coordinator were in harmony with the legislation incorporated in the Dale-Lehlbach bill recently passed by both Houses.

After long and arduous efforts the board has completed its task in the preparation of a unified procedure for the handling of retirement matters, and has made its recommendations to the Chief Coordinator.

Permanent Conference on Printing

The standardization of permanent forms continues to be one of the principal functions of the conference. The increased use of these forms has now become an essential factor in the economical production of printing and binding of the Government, and renewed efforts are being made to eliminate duplication of forms used by the departments and establishments by systematic standardization. During the past year a number of standard forms were revised with a view to further economies, and additional forms were standardized and promulgated.

A recommendation was submitted that the printing of departmental names on cloth-bound copies of the Congressional Directory serves no purpose of utility and should be omitted in the interest of economy, but that the same number of cloth-bound copies as heretofore should continue to be furnished without cost to the executive departments and independent establishments.

As a result of constant effort to remedy the abuse on the part of authors of making extravagant alterations in proofs, the number of "authors' alterations" have been greatly reduced. It has been decided that hereafter the cost of "authors' alterations" will appear as a separate item on all printing bills rendered by the Government Printing Office.

A working agreement between the Interdepartmental Board on Simplified Office Procedure and the Permanent Conference on Printing as to their respective functions in connection with standardization of forms has been consummated.

A more general adoption of a sales policy for disposing of Government publications has been under consideration for some time. The conference expresses the belief that special effort should be made by each branch of the Government service to restrict, so far as is consistent with the performance of its duties as prescribed by law, the free distribution of all publications issued by it to stimulate the sale of its publications, whether they be of general interest or of special interest to educational, scientific, or trade groups. Special effort also should be made to promote sales of Government publications, capitalizing the sales value of the publications by official

announcements to be printed and distributed by the Superintendent of Documents, that officer acting upon recommendations of issuing offices as to type of publicity believed best to stimulate such sales.

To determine the feasibility of standardizing fan-fold forms used in the various departments of the Government, a systematic survey was conducted by the forms committee during the past year. Because of advantages of these forms, it is believed that their use will continue to grow, and while it seems advisable to take steps to place the Government Printing Office in a position to meet future demands, it has been deemed advisable by the committee in charge to further investigate the subject before making final recommendations.

The Bureau of the Budget has approved the conference's amendment to extend to "the heads of all independent establishments, including members of commissions and boards, and the assistant secretaries of the executive departments" the right to order embossed letterheads or noteheads and envelopes, previously limited "to the President, Vice President, heads of executive departments, and the State Department for diplomatic correspondence exclusively." Each of the officials mentioned in the amendment is allowed 1,000 embossed letterheads per annum.

Under authority of the Public Printer, the Style Manual of the Government Printing Office is undergoing a complete revision. This work is being handled by a committee composed of representatives of the Government Printing Office and of the executive departments, two of the latter of whom are also members of the Permanent Conference on Printing. The revision of this manual is an enterprise in which all departments of the Government are deeply interested; its early completion is essential in order to minimize disputes over points of differences between departments and the Government Printing Office. The work is progressing satisfactorily, but it should not be done hastily. It is hoped that in its revised form the manual will meet the needs of printers, publishers, and editors in a nation-wide way.

In cooperation with the Interdepartmental Board on Simplified Office Procedure, the Interdepartment Board on Contracts and Adjustments, the Bureau of the Budget, and the General Accounting Office, a number of forms have been promulgated since the Permanent Conference on Printing first began its activities of standardizing printing and binding.

PAN AMERICAN SANITARY BUREAU

Among the activities of the sanitary bureau directed toward the correlation and standardization of effort may be mentioned the following:

The Pan American Sanitary Code prescribes a standard of requirements for the classification of the ports of the several American republics, which classification requires revision from time to time. Identical letters were sent to the directing heads of all the republics, requesting this revision in such manner as to indicate the present state of each port with regard to the presence or absence of quarantinable diseases, and with regard to facilities for caring for vessels and personnel in case such diseases may be found on board.

Inquiry and suggestion were made in like manner regarding the use of the standard (Pan American) bill of health.

Inquiry and suggestion were made regarding the adoption of a standard nomenclature for causes of death.

Information was requested concerning the status of the following diseases (and other topics) with a view of working out standard methods for combating such diseases, or for adopting uniform procedures of sanitary administration, where such action may be feasible, namely, intestinal parasitoses, tuberculosis, public health legislation, hospitals, and school hygiene.

Standard procedures for the reporting of the presence of contagious disease throughout the world were followed in order that the health authorities of all the American republics might be kept promptly advised.

PAN AMERICAN UNION

The Second Pan American Conference on Uniformity of Specifications in 1927, approved a number of resolutions among which were:

To recommend to the Governments of the various Latin American republics the advantage resulting from the fullest collaboration of their respective Federal departments with the Inter American High Commission and its national section in an educational campaign among all producers and exporters interested in inter-American commerce for the adoption in exporting of the manner of classification and packing indicated in order to obtain in the principal buying country the best conditions.

To recommend the advantages which would be derived from procuring the services of experts for the cultivation and distribution of their various exportable products, in order to obtain with the greatest rapidity and facility a production corresponding to the types and forms most acceptable in the consuming markets.

In order that the work may be initiated immediately and some practical results realized more quickly, steps be taken to adopt uniform specifications of products which are now being exported in greater quantities from each country to the United States.

There should be adopted generally the same names for specifications of identical products, so that in the future one product or its different classes will not be designated by different names. The exchange of nomenclatures and samples among the Latin American countries ought to be encouraged, and commissions necessary for this work, composed of representatives of the countries interested, should be organized.

That there be created a permanent committee composed of representatives of the various countries interested, residing in Washington, to study ways and means of organizing an inspection service for animal and vegetable products which may guarantee and facilitate commerce in that class of products.

The Governments should procure the introduction and general adoption in their respective countries of the system of classifying wool which uses as a basis the diameter of fiber and which is at present employed in the United States and England, and for which undertaking requests may be made to the Department of Agriculture in Washington for samples and data necessary.

To recommend that in the preparation of bundles of fleece, there be used neither sisal twine nor twine of vegetable fibers, badly wound, which becoming mixed with the wool, injure its quality and make difficult its manufacture.

To recommend that there be established a bulletin for commercial, industrial, and agricultural propaganda which shall be devoted to the study of these matters preferably from the point of view of uniformity of specifications.

That this bulletin be published by the central executive council of the Inter American High Commission in Spanish, English, Portuguese, and French, and its cost be borne by the various countries in proportion to the number of copies for which each Government may subscribe, the bulletin to be distributed widely and gratuitously in each country.

The national sections of the Inter American High Commission should send to the central executive council for publication in this bulletin any document relative to specifications originating in their respective countries and any information which they may consider of common interest.

To recommend to the leading associations of manufacturers and exporters in the United States the great advantage which would result from their agreement in the shortest time possible to adopt gradually the decimal metric system in their exporting to Latin America, beginning by indicating the equivalent metric decimal in their bills of lading and shipping documents, together with the corresponding American system, and gradually adopting in

their exportations to the above mentioned countries in all cases in which this may be possible containers and units agreeing strictly with the metric decimal system, and also that they agree that the exporters in Latin America indicate their shipments in units of the metric decimal system as near as possible to those units now used, but avoiding in all cases fractions.

PERSONNEL CLASSIFICATION BOARD

The Personnel Classification Board is charged by Congress with the administration of the classification act of 1923, as amended, the purpose of which was to standardize the salaries of civilian positions in the departments at Washing by means of a classification plan whereby such positions were to be arranged in classes according to the kind, importance, difficulty, responsibility, and value of the work involved.

During the past year the board at the request of Congress, has developed a classification and a salary standardization plan for about 104,000 positions in the field services of the Government. As a part of this plan it has prepared 1,633 standard "class specifications." These specifications describe the kinds of Government positions that fall in a given class by reason of the similarity and commensurability of the duties and responsibilities which they involve. They show, for each class: A proposed standard official title by which the positions should be known and recorded; a broad summary of the duties and responsibilities of positions in the class; a detailed exposition of examples of work performed or typical positions in the class; the minimum qualifications as to education, experience, knowledge, and ability that should be required of employees for entrance into positions in the class; and by means of a symbol, the place of the class in the proposed salary standardization plan.

PUBLIC BUILDINGS AND PUBLIC PARKS OF THE NATIONAL CAPITAL

The Office of Public Buildings and Public Parks of the National Capital has continued to cooperate with the various standardizing and specification-making activities of the various Federal agencies by designating employees of the office to represent it on the following boards and committees:

- 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.
- General Supply Committee.
- Twenty subcommittees of the committee on commodities of the Federal Purchasing Board.

THE PANAMA CANAL

This establishment is represented on the executive committee of the Federal Specifications Board and a number of its technical committees; the American Standards Association; and the American Society for Testing Materials.

The Panama Canal drafts its own specifications for materials not covered by Federal specifications, and certain materials not covered by the Navy and War Departments. The Panama Canal frequently uses War and Navy Department specifications for materials not covered by Federal specifications.

UNITED STATES BUREAU OF EFFICIENCY

The bureau cooperated with the National Bureau of Standards in research to establish standard methods and equipment for testing paper, especially currency paper.

UNITED STATES CIVIL SERVICE COMMISSION

The research program outlined below is serving as a basis to improve such factors as personnel selection, placement, and adjustment in the Federal service. The coordination in this work with schools and industries does not represent additional research, but a wider utilization of the standards developed for the Federal service. This undertaking includes the following major steps:

Study of a selected number of civil-service positions with regard to the actual duties performed.

Determination, on the basis of actual case histories, of opportunities for employment in, and of present and possible lines of promotion in, those positions. Critical study of examination standards in relation to each other and to the requirements of the positions involved.

Improvement of the validity and the practicability of examinations.

Study, in industry as well as in the Government service, of factors, such as experience, not measured by tests.

Release of tests to industries, to determine industrial standards of selection and to secure a clearer understanding of the limitations, as well as the values, of the commission's methods and measures.

Establishment of national standards, making test scores more meaningful to placement officers.

Release of tests to schools, and development of cooperative relations with research, guidance, and personnel directors in universities and secondary schools.

Release to schools of tables showing relationship between test scores on the commission's general intelligence tests and the intelligence tests used in schools and colleges.

Development of a guidance card which will enable the applicant to analyze opportunities in relation to his qualifications.

Preparation of sample tests, showing the nature of the examinations used for the positions listed on the guidance card.

Coordination of the use of eligible registers, after determining the extent to which eligibility for one position indicates ability to fill other positions.

Dissemination, among present employees, of information concerning lines of promotion, possibilities of transfer, and requirements which must be met in order to secure such promotion or transfer.

The commission has during the past year devoted particular attention to standardizing procedure of administering examinations. Much attention has formerly been given to developing standard procedure for constructing examinations, in order to insure that alternative series are comparable; that is, are of equal difficulty so that a competitor who makes a given score on one series would make the same score if he were examined on a different day and with an alternative series. Parallel with the development of standard construction procedure and objective tests, it has been possible to develop objective methods of scoring examinations. Administrative procedures have been studied as a part of the development of different objective tests. Because its examinations are given over the entire country, however, and must, therefore, be administered by hundreds of different examiners, and because the commission has little contact with the persons who are to do the examining, the commission has a unique problem in securing uniformity of administration.

Specific directions as to each detail in the administration of the new stenographer and typist examination were prepared. They include directions, verbatim, as to the instructions to be given to the competitors at each point in the examination. These directions for administration were bound in a manual, together with a dummy set of examination papers. In order to insure thorough understanding of these directions and familiarity with the arrangement of the material, the blanks to be filled by the competitors, and the information which the sheets give the competitors, a manual was mailed to each examiner two weeks before the date of the examination.

A letter which directed each examiner to study the directions and dummy examination requested replies to a series of questions based on the information contained in them. As was explained to examiners, the purpose of these questions was to insure uniformity in different examiners' methods of conducting the examination. To each examiner whose replies indicated imperfect or incomplete understanding of the procedure, a form letter of detailed explanation was sent, marked to call attention to the points where, according to his replies, his method of administration would otherwise not conform to the standard procedure.

UNITED STATES SHIPPING BOARD AND UNITED STATES SHIPPING BOARD MERCHANT FLEET CORPORATION

The United States Shipping Board has cooperated to the fullest extent in developing and adopting such standards as are applicable to the activities of the Shipping Board and its agent, the Merchant Fleet Corporation. This has been accomplished through representation on the various standardization bodies, such as the Federal Specifications Board and the American Marine Standards Committee. Various individuals are also representatives of the corporation on committees of technical associations, such as the American Society for Testing Materials, the American Standards Association, etc. The fleet corporation uses a large quantity and variety of materials. Wherever it has been practicable, these items have been standardized and are purchased under standard specifications, many items in mass lots. These items include paints, packings, cordage, linens, chinaware, condenser tubes, boiler tubes, refractory materials, etc. The corporation has made it a practice to adopt such established standards as are applicable in the operation of its ships. It has taken a very active part in the preparation of the standards of the American Marine Standards Association and has freely loaned its personnel and experience toward the preparation of these standards.

UNITED STATES VETERANS' BUREAU

Extension No. 8 of the Schedule of Disability Ratings, issued during the year, prescribes the percentage ratings for the disabilities caused by epilepsy and the psychoneuroses occurring in various degrees and combinations.

A Manual for Medical Examiners has recently been prepared to aid in securing standardized concepts and methods in physical examinations for the purpose of facilitating the visualization and evaluation of disability from disease or injury for compensation and insurance purposes.

There has recently been issued a Manual for Medical Service Supervisors which outlines a procedure for the inspection of hospitals, regional offices, combined facilities, and medical treatment stations. This was done in order to effect standardized inspection methods in the bureau.

Definite patient-personnel ratios have been established for the various kinds of hospitals, namely, general medical and surgical, tuberculosis, and hospitals for the treatment of beneficiaries with neuropsychiatric diseases. These ratios are used only as general guides in making determination regarding personnel requirements and apply particularly to the following types of medical personnel:

Ward medical officers (exclusive of administrative medical personnel and specialists).

Nurses (exclusive of administrators, supervisors, or clinical personnel).

Attendants (exclusive of janitors, laborers, etc.).

Dietitians.

Physiotherapy aides.

Occupational therapy aides.

Social workers.

There are being issued from time to time "clinical and laboratory bulletins" outlining specifically the standard methods to be employed by the field stations in the clinical and laboratory diagnosis of the various disabilities. The bureau also has standardized a list of professional and scientific books and journals for field stations.

Other standards which the bureau has developed or is in the process of developing are not included herewith as they are primarily for use in the internal administration of the bureau and it is not believed they would be of general interest.

V. NATIONAL 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 1930 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 1,900 pamphlets have been issued to date. Releases to the daily press give briefly the outstanding features of the bureau's activities from a popular point of view. Technical abstracts are prepared for the use of scientific and technical journals. New knowledge of general or pure science and results of direct application in the industries are published in the Bureau of Standards Journal of Research, which is issued once a month. This journal 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—for example, 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. Charts, conference reports, and material not suitable for other series appear as Miscellaneous Publications.

The program for the simplification of commercial practice leads to definite proposals known as Simplified Practice Recommendations, while agreements on the desirable minimum quality or grading of products are published as Commercial Standards.

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 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 for use in answering 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 cards 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 devising 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 of certain 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 imported 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 new data on the properties of ammonia and carbon dioxide 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 associate¹ plan permits industrial associations of groups to place qualified men at the bureau for intensive study of selected problems approved by the Director of the National 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

[As of November 1, 1930]

| Assigned by— | General field of research | Specific project | Research associate |
|--|---------------------------|--|--|
| American Association of Textile Chemists and Colorists, W. E. Hadley, secretary, care of Clark Thread Co., Newark, N. J. | Textiles | Assisting in study of methods for testing fastness to light of dyed fabrics. | Smith, W. C. |
| American Dental Association, 58 East Washington Street, Chicago, Ill. | Dentistry | Study of dental materials. | Paffenbarger, G. C.; Taylor, N. O. |
| American Electric Railway Association, R. H. Dalgleish, president, Capital Traction Co., Washington, D. C. | Bearings | Lubrication of journal bearings. | McKee, T. R. |
| American Face Brick Association, 130 North Wells Street, Chicago, Ill. | Structural | Face brick absorption and transverse compression; efflorescence. | Hall, J. V., Jr.; Palmer, L. A. |
| American Foundrymen's Association, Cleveland, Ohio. | Metallurgical | Liquid shrinkage in metals. | Ash, E. J. |
| American Gas Association, 342 Madison Avenue, New York, N. Y. | Gas | Research on gas; corrosion of pipe lines. | Miller, N. L.; Ewing, S. |
| American Institute of Steel Construction, New York, N. Y. | Structural | Fire tests on battle deck construction. | Welch, C. W. |
| American Petroleum Institute, 250 Park Avenue, New York, N. Y. | Petroleum | Properties of petroleum products. | Bradt, L. J., Jr.; Bruun, J. H.; Green, C. B.; Harrington, E. A.; Hoover, S. R.; Jessup, R. S.; Leslie, R. T.; Rose, F. W., Jr.; Schickman, S. T.; Scott, G. N.; Snyder, E. H.; White, J. D. |
| American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, N. Y. | Heat | Steam-table research and high temperature measurements. | Osborne, N. S.; Stimson, H. F.; Snyder, G. H. S.; Bell, H. F.; Holton, W. B. |
| American Society for Testing Materials, 1315 Spruce Street, Philadelphia, Pa. | Structural | Research in cement; testing. | Dwyer, J. R.; Wagner, L. A. |
| American Standards Association, 29 West Thirty-ninth Street, New York, N. Y. | Safety Engineering | Development of instruments and methods for testing elevator safety equipment. | Brown, L. W.; Dickinson, J. A.; Seaquist, W. H. |
| Asphalt Shingle and Roofing Institute, 2 West Forty-fifth Street, New York, N. Y. | Roofing | Relative values of different fibers used in roofing felts. | Strieter, O. G. |
| Associated Knit Underwear Manufacturers of America (Inc.), 329 Main Street, Utica, N. Y. | Textiles | Standardization and simplification of underwear sizes; methods of manufacture. | Hamlin, C. H. |
| Atlas Luminite Cement Co., 25 Broadway, New York, N. Y. | Cement | Research in cement; testing, etc. | Harrison, W. W.; Rapp, P.; Rhea, R. H. |
| Brown Co., Berlin, N. H. | Paper | Permanency of paper. | Rasch, R. H.; Stone, G. |
| Bunting Brass & Bronze Co., 715-755 Spencer Street, Toledo, Ohio. | Metallurgical | Testing of bronze. | Eggenschwiler, C. |
| Bureau of Efficiency, Washington, D. C. | Paper | Routine testing of paper. | Worthington, V. |
| Cast Iron Pipe Research Association, 566 Peoples Gas Building, Chicago, Ill. | Soil corrosion | Investigation of causes of soil corrosion. | Grodsky, V. A. |
| Committee on Glass, E. C. Sullivan, chairman, Corning Glass Works, Corning, N. Y. | Glass | Physical properties of glass. | Saunders, J. B. |
| Common Brick Manufacturers of America, 2121 Guarantee Title Building, Cleveland, Ohio. | Structural | Moisture transmission of brick walls. | Lovewell, C. E.; McBurney, J. W. |
| Cooper, Hugh L., Co. (Inc.), 101 Park Avenue, New York, N. Y. | do. | 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. G. |

Research associates—Continued

| Assigned by— | General field of research | Specific project | Research associate |
|--|---------------------------|--|---|
| Dardet Thread Lock Corporation, 120 Broadway, New York, N. Y. | Mechanics | Looking devices for screw threads | Goldberg, M.; Olson, A. A.; Slaughter, T. F. |
| Indiana Limestone Association, Bedford, Ind. | Structural | Study of physical properties of Bedford limestone | Dutton, H. H. |
| International Association of Electrotypes, Dan A. Hoynes, 1760 East Twenty-second Street, Cleveland, Ohio. | Plating | Plating of electrotypes | Bekkedahl, N. P. |
| Johns Manville Co., Manville, N. J. | Heat transfer | Thermal conductivity of insulating materials | Kennard, R. B. |
| Midvale Co., Philadelphia, Pa. | Metallurgical | Properties of metals at high temperatures | Kahlbaum, W. |
| National Association of Glue Manufacturers, J. R. Powell, secretary, care of Armour Glue Works, 1335 West Thirty-first Street, Chicago, Ill. | Paper sizing | Use of glue in paper sizing | Hamill, G. K. |
| National Association of Hosiery and Underwear Manufacturers, 334 Fourth Avenue, New York, N. Y. | Textiles | Study of methods of manufacture of hosiery and knitted goods | Schenke, E. M.; Shearer, H. E. |
| National Building Units Association, 1600 Arch Street, Philadelphia, Pa. | Structural | Concrete building units | Bowen, E. E. W. |
| National Lead Co., 105 York Street, Brooklyn, N. Y. | Chemistry | Research in pigments | Sparks, J. W. |
| National Research Council, Washington, D. C. | General | Radio, insulating materials, deterioration of paper, gumming of petroleum, mechanics, etc. | Allen, W. F.; Austin, A. V.; Beall, J. R.; Cole, C.; Cruickshanks, B. C.; Gardiner, G. W.; Hicks, J. F. G.; Kimberly, A. E.; Mair, B. J.; Marton, M. R.; Miller, C. E.; Wharton, A.; Pendorff, H.; Gough, C.; Spence, K. J. |
| National Terra Cotta Society, 19 West Forty-fourth Street, New York, N. Y. | Structural | Investigation of architectural terra cotta | Polo, G. R.; Sehurecht, H. G. |
| Nonferrous Ingot Metal Institute, 308 West Washington Street, Chicago, Ill. | Metallurgical | Nonferrous ingot metal research | Gardner, H. B. |
| Norton Co., Worcester, Mass. | Abrasives | Electric furnace abrasives | de Sveshnikoff, V. V. |
| Portland Cement Association, 111 West Washington Street, Chicago, Ill. | Structural | Constitution and hardening of Portland cement | Ardan, A. T.; Bogue, R. H.; Briant, R. C.; Dillon, M. M.; Lerch, W.; Reeves, R. J.; Taylor, W. C. |
| Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y. | Automotive | Cooperative fuel research | Bridgman, O. C.; Bright, B. B.; Burr, R. A.; Carter, F. R.; Ellenberger, W. J.; Hicks, R. L.; Rodgers, G. C.; Sprinkle, L. W.; Webber, W. W. |
| Squibb & Sons Co., E. R., New Brunswick, N. J. | do. | Investigation of antifreeze mixtures | Quercfeld, D. W. |
| Steel and Tubes (Inc.), 224 East One hundred and thirty-first Street, Cleveland, Ohio. | Mechanics | Tension, compression, elongation, deformation, etc., tests of tubes. | Sesquist, E. O. |

Current work of research associates relating to standards of quality, performance, or practice is given under activities and accomplishments.

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 one 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. Branch testing laboratories are maintained at Northampton, Pa.; Columbus, Ohio; Denver, Colo.; and San Francisco, Calif. Tests of this character are made for the public only in instances where private laboratories are not suitably equipped.

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.—In accordance with law, the National Bureau of Standards makes tests and carries out investigations for other Government departments. Because of the large

amount of this official work it is impracticable for the bureau 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 311 commercial testing laboratories with 138 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

COMMERCE

The National Bureau of Standards has assisted over 100 industries 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 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, cooperation with industry in selecting and establishing definite grades and qualities as commercial standards, promulgation of nationally recognized specifications, and the compilation of lists of willing-to-certify manufacturers of products made according to those specifications.

Assistance in the correlation of the specifications produced by the Federal Specifications Board with those produced by commercial agencies is rendered by the commercial standards group, which has liaison duties with other branches of the Department of Commerce and with other departments on matters relating to commercial standards.

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. This committee is comprised of the following:

G. A. Renard, secretary, National Association of Purchasing Agents, New York, N. Y.

F. M. Feiker, managing director, Associated Business Papers (Inc.), of New York, N. Y.

E. W. McCullough, manager, department of manufacture, Chamber of Commerce of the United States, Washington, D. C.

L. G. Puchta, vice president, National Supply and Machinery Distributors' Association, Cincinnati, Ohio.

A. W. Shaw, Chicago, Ill.

Rear Admiral Harry H. Rousseau, chief coordinator, Bureau of the Budget, Washington, D. C.

A. A. Stevenson, vice president in charge of manufacture (Standard Steel Works Co., Philadelphia), representing the American Standards Association.

L. W. Wallace, executive secretary, American Engineering Council, Washington, D. C.

Simplified Practice.—Simplified practice is a method of eliminating superfluous variety. It is applied by the collective action of producers, distributors, and consumers, with the cooperation of the division of simplified practice, to eliminate needless variety in sizes, dimensions, and types of commonplace commodities. This method is based on the sensible avoidance of waste caused by excessive and uneconomic diversity. Simplified practice decreases costs and increases the utility and efficiency of production, distribution, and consumption. These ends are accomplished by voluntarily limiting varieties of stock items to those for which there is a constant demand.

Commercial Standards.—A service and procedure has been arranged for establishing as "commercial standards" such nationally recognized specifications as are fully indorsed by the industries concerned. The procedure provides ample safeguards to insure full cooperation and coordination without domination by any group in the selection and approval of a standard. The chief mission is promotional in character to provide support for a specification or a standard which an industry and its related groups may want to promulgate on a nation-wide or a world-wide basis; to determine its eligibility for promulgation; to publish and broadcast it in the event the prerequisites, including a satisfactory majority of signed acceptances, have been met; to facilitate the application of the certification plan for the assurance and convenience of the small purchaser; to arrange a forum in cooperation with the Bureau of Foreign and Domestic Commerce for the selection and translation of specifications in the promotion of foreign commerce, and to provide a means for controlled periodical audits of adherence.

Standards in Foreign Trade.—Cooperative arrangements exist between the Bureau of Foreign and Domestic Commerce and the National Bureau of Standards for the translation and publication of such commercial standards as may possess potential foreign markets.

Specifications.—To promote and facilitate the use and unification of specifications, the National Bureau of Standards carries on activities involving cooperation with (a) technical societies; trade associations; (b) and (c) Federal, State, and municipal government specifications making and using agencies; (d), (e), and (f) producers, distributors, and consumers; and (g) testing and research laboratories.

(a) Cooperation with technical societies and trade associations includes ascertaining the standardization and specification promoting activities of these organizations and bringing to their attention the work being done by the National Bureau of Standards. It also

includes the offering of such assistance as it can render in bringing about a change from the prevalent hit-or-miss method of specifying, manufacturing, and testing to a logical method of formulating specifications, manufacturing in conformity therewith, and testing to insure or guarantee compliance therewith.

(b) Cooperation with Federal Government specifications making and using agencies involves bringing the Federal specifications to the attention of the maximum number of producers and the maximum number of users of commodities covered by these specifications, thereby assisting in broadening the field of supply.

(c) Cooperation with State and municipal standardizing and specifications using agencies involving the compilation of a complete list of such agencies, ascertaining the scope of their activities and offering to them the friendly assistance of the National Bureau of Standards in substituting the specification for the trade brand method of buying.

(d) Cooperation with producers involves the compilation of complete lists of manufacturers of commodities covered by Federal specifications or those conforming to commercial standards, and distributing to buyers lists of such of these manufacturers as are desirous of supplying material in conformity with these specifications and standards.

(e) Cooperation with distributors involves bringing to their attention the benefits to be derived by them, both as buyers and as sellers, from handling nationally specified, certified, and labeled commodities.

(f) Cooperation with consumers involves bringing to their attention the benefits to be derived by them from buying under nationally recognized specifications and commercial standards and facilitating the use of specifications by means of the certification plan applied to nationally recognized specifications (guarantee of quality in delivered commodities which may or may not be labeled) and labeling applied to national standard commodities (for identification; may or may not carry a guarantee).

(g) Cooperation with testing and research laboratories involves the compilation, keeping up to date, and distribution of complete lists of commercial testing and college research laboratories for the benefit not only of these laboratories, but also of both the manufacturers and the users of commodities purchased under specifications.

Building and Housing.—The bureau cooperates with business, technical, and professional groups in practically all its undertakings on building and housing. Its work to modernize building codes and to encourage improved standards for the quality of building construction promotes the practical application of the latest development in design and use of building materials. In furthering home ownership, an effort is made to develop an enlarged, steadier, more intelligent, and more discriminating demand for soundly built dwellings, the largest single class of buildings which the construction industries provide. The bureau also cooperates with many business and professional groups in efforts to distribute building activity more evenly throughout the year and to secure less fluctuation from

year to year. During the past year particular attention has been given to the Government's public works construction program. The work on city planning and zoning has in mind the broad objective of buildings made more useful because well located with respect to other buildings, a well-coordinated street system and appropriate public works. Good city planning and zoning likewise encourages stability in land values and property uses, and thereby contributes to the demand for durable structures.

LIAISON

Advisory Committees.—Where a group interested in the formulation of standards for a given industry or in the investigation of specific subjects are not otherwise organized for the purpose the bureau encourages the formation of an advisory committee. These committees function much the same as an informal industrial committee, except that the secretarial work is usually conducted by the bureau.

Advisory committees

| Name | Purpose | Secretary | Membership |
|--|--|---|---|
| Advisory committee on automobile tires. | To advise on technical questions of specifications and methods of test. | A. D. Kunze, Rubber Manufacturers Association, 250 West Fifty-seventh Street, New York, N. Y. | Automobile tire manufacturers. |
| Advisory committee on cement..... | To advise on work dealing with the constitution and hardening of Portland cement. | George E. Warren, Portland Cement Association, 33 West Grand Avenue, Chicago, Ill. | Committee 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, National 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, National 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 design of National Hydraulic Laboratory. | To advise on general features of design of building and equipment. | J. B. Hill (chairman), Atlantic Refining Co., 3144 Passyunk Avenue, Philadelphia, Pa. | Representatives of Government departments and engineers from civil life. |
| Advisory committee on determination of the composition of petroleum. | For consultation on technical aspects of petroleum investigation. | I. J. Fairchild, National Bureau of Standards, Washington, D. C. | American Petroleum Institute. |
| Advisory committee on enameled sanitary ware. | To standardize nomenclature, definitions, grading rules, essential dimensions, and types of enameled sanitary ware. | John S. Kemp, 82 Beaver Street, New York, N. Y. | All manufacturers of enameled sanitary ware. |
| Advisory committee on fire hazard tests of jute. | To determine whether jute is susceptible to spontaneous heating. | F. H. Frankland, 2000 Madison Avenue, New York, N. Y. | Committee of Marine Underwriters. |
| Advisory committee on fire tests of welded steel floor construction. | To conduct tests to determine the fire resistance of a new type of welded steel floor construction. | John N. McCullough, National Association of Hosiery and Underwear Manufacturers, 334 Fourth Avenue, New York, N. Y. | Committee of American Institute on Steel Construction. |
| Advisory committee on hosiery..... | To advise on technical questions concerning hosiery. | A. D. Kunze, Rubber Manufacturers Association, 250 West Fifty-seventh Street, New York, N. Y. | Hosiery manufacturers. |
| Advisory committee on hospital rubber supplies. | To advise on technical questions of specifications and methods of test. | T. Blackadder (chairman), care of Charles Lennig & Co., Bridesburg, Pa. | Manufacturers of hospital supplies. |
| Advisory committee on leather..... | To advise on effects of various acids on life and properties of leather. | J. A. Wilson (chairman), care of A. F. Gallun & Sons (Inc.), Milwaukee, Wis. | American Leather Chemists Association and Tanners Council of America. |
| Do..... | To advise on technical questions concerning properties of salt for curing skins. | A. G. Orthmann (chairman), 447 Virginia Street, Milwaukee, Wis. | Calf Tanners Association. |
| Do..... | To advise on technical questions concerning properties of leather. | | American Leather Chemists Association. |

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| Advisory committee on mechanical rubber goods. | A. D. Kunze, Rubber Manufacturers Association, 250 West Fifty-seventh Street, New York, N. Y. | Manufacturers of mechanical rubber goods. |
| Advisory committee on paper. | Jesse H. Neal (general manager) and Charles W. Boyce (secretary), American Paper and Pulp Association, New York, N. Y. | Pulp and paper manufacturers. |
| Advisory committee on porcelain plumbing fixtures. | I. J. Fairchild, National Bureau of Standards, Washington, D. C. | All manufacturers of porcelain plumbing fixtures. |
| Advisory committee on rubber floor tile. | A. D. Kunze, Rubber Manufacturers Association, 250 West Fifty-seventh Street, New York, N. Y. | Manufacturers of rubber floor tile. |
| Advisory committee on standardization of builders' hardware. | I. J. Fairchild, National Bureau of Standards, Washington, D. C. | All manufacturers of builders' hardware. |
| Advisory committee on thermochemical research. | Representatives of General Chemical Co., Naval Research Laboratory, and National Bureau of Standards. | Representatives of General Chemical Co., Naval Research Laboratory, and National Bureau of Standards. |
| Advisory committee on thermodynamic properties of petroleum products. | American Petroleum Institute. | American Petroleum Institute. |
| Advisory committee on underwear. | Underwear manufacturers. | Underwear manufacturers. |
| Advisory committee on wool. | Wool textile manufacturers. | Wool textile manufacturers. |
| Building-code committee. | Architects and engineers. | Architects and engineers. |
| Certification committee, Horological Institute of America. | Examining board, Horological Institute of America. | Examining board, Horological Institute of America. |
| Committee on investigation of insulating liquids. | Representatives of electric light and power companies. | Representatives of electric light and power companies. |
| Committee on properties of steam and the extension of the steam table. | American Society of Mechanical Engineers. | American Society of Mechanical Engineers. |
| Ferrous metals advisory committee. | American Society for Testing Materials, associations of automotive, mining, and metallurgical engineers and foundrymen, and American Society for Steel Treating. | American Society for Testing Materials, associations of automotive, mining, and metallurgical engineers and foundrymen, and American Society for Steel Treating. |
| Fuels research committee. | Society of Automotive Engineers. | Society of Automotive Engineers. |
| Headlight research subcommittee. | Do. | Do. |
| Joint steering committee on cooperative fuel research. | C. B. Veal (Asst. Gen. Mgr.), care of Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y. | Society of Automotive Engineers; American Petroleum Institute; National Automobile Chamber of Commerce. |
| Manufacturers' advisory committee on Fourdrinier wire cloth. | G. W. Wray, National Bureau of Standards, Washington, D. C. | All manufacturers of Fourdrinier wire cloth. |

Advisory committees—Continued

| Name | Purpose | Secretary | Membership |
|---|--|--|---|
| Manufacturers' advisory committee on vitreous china plumbing fixtures. | To standardize nomenclature, definitions, grading rules, essential dimensions, and types of vitreous china plumbing fixtures. To guide the bureau in selection of research problems in nonferrous metals. | I. J. Fairchild, National Bureau of Standards, Washington, D. C. | All manufacturers of vitreous china plumbing fixtures. American Society for Testing Materials, Government departments, and associations of electrochemical, mechanical, mining and metallurgical engineers. Associations of radio engineers, broadcasters, radio and electrical manufacturers. Textile chemists and colorists. |
| Nonferrous metals advisory committee. | | W. M. Corso, 810 Eighteenth Street, N.W., Washington, D. C. | |
| Radio advisory committee. | To assist in formulating and revising program of research in radio communication. | J. H. Dollinger, National Bureau of Standards, Washington, D. C. | Architects, lawyers, credit men, and associations connected with building or construction operations. Sanitary and civil engineers. |
| Research committee of American Association of Textile Chemists and Colorists. | To advise on technical questions dealing with the application and testing of dyes. | E. H. Killheffer, president, Newport Chemical Works (Inc.), Passaic, N. J., and Prof. L. A. Olney, Lowell Institute, Lowell, Mass. | |
| Research committee of American Dental Association. | To standardize purchase and use of dental materials. | Dr. R. H. Volland (chairman), Iowa City, Iowa. | |
| Research committee of American Electroplaters Society. | To advise on electroplating research. | R. J. O'Connor (chairman), 41 Bancroft Avenue, Bridgeport, Conn. | |
| 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. | |
| Riding quality research subcommittee. | To assist in formulating program of research on riding qualities of motor vehicles. | C. B. Veal (assistant general manager), care of Society of Automotive Engineers, 29 West Thirty-ninth Street, New York, N. Y. | |
| Standard State mechanics' lien act committee. | To draft a uniform mechanics lien act for consideration by State legislatures. | Dan H. Wheeler, National Bureau of Standards, Washington, D. C. | |
| Subcommittee on plumbing, building-code committee. | To formulate and recommend provisions for State and municipal regulations of plumbing installations. | George N. Thompson, National Bureau of Standards, Washington, D. C. | |

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, master specifications, and commodity standards to the final check of delivered material for conformity to specification requirements.

The fundamental 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 the red cadmium line 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. Extensive research is crystallized in the standardization of radio-frequency or wave-length measurements, now a vital part of our radio communication system, though an undreamed requirement of 10 years ago. It is therefore essential that the bureau should 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 various departments of the Government in checking delivered materials for compliance with specifications. Such research and tests provide the necessary foundation 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

Wind-Tunnel Turbulence.—A study of the correlation of force measurements on spheres and airship models with turbulence as measured by the hot-wire anemometer has been published. The report contains the theory of the effects of turbulence in wind-tunnel experiments. During the past year the significance of measurements with the hot-wire anemometer has been investigated by studying

the transition from laminar to eddying flow around a thin flat plate parallel to the wind. This work has been carried out in cooperation with the National Advisory Committee for Aeronautics.

Publication.—Effect of Turbulence in Wind-Tunnel Measurements, by H. L. Dryden and A. M. Kuethe, National Advisory Committee for Aeronautics' Technical Report No. 342, 1930.

Ailerons.—The bureau has cooperated with the National Advisory Committee for Aeronautics and the Aeronautics Branch of the Department of Commerce in a study of the effect of variation of chord and span of ailerons on rolling and yawing moments at high angles of attack.

Publication.—Effect of Variation of Chord and Span of Ailerons in Rolling and Yawing Moments at Several Angles of Pitch, by R. H. Heald, D. H. Strother, and B. H. Monish, National Advisory Committee for Aeronautics' Technical Report No. 343, 1930.

Characteristics of Airfoils at High Speeds.—In cooperation with the National Advisory Committee for Aeronautics, measurements were made on the aerodynamic characteristics of eight airfoils of circular-arc section at speeds up to and slightly above the speed of sound. It was found that these airfoils are more efficient at high air speeds than airfoils of conventional type. The circular-arc section is consequently advantageous for use in designing high-speed propellers.

Strength of Welded Aircraft Joints.—The fuselages and other portions of airplane structures are, in many cases, made of chromium-molybdenum steel tubing. About 90 per cent of the joints are welded, using the oxyacetylene torch. To assist the aeronautics branch of the Department of Commerce in determining the airworthiness of airplanes submitted for approval, the strength and efficiency of 40 types of welded joints were determined. The welder was qualified under a procedure prepared by the American Bureau of Welding. For some of the types of joints, it was found that the strength was increased about 30 per cent by the use of gusset plates welded to the tubes.

Publication.—Testing Welded Joints for Aircraft Structures, by H. L. Whittemore, *Airway Age*, 10, No. 2, p. 161, 1929.

Fixation of Struts.—The strength of tubular steel struts as used in airplane fuselages, loaded in compression with their ends restrained, is being investigated in cooperation with the National Advisory Committee for Aeronautics and the Navy Department. In the laboratory tests the restraint (the same at each end) is inversely proportional to the rotation of the fixture holding the end of each strut and is applied by means of springs, the stiffnesses of which can be changed for different tests. One series of chrome-molybdenum tubes, diameter $1\frac{1}{2}$ inches, thickness 0.058 inch, has been tested with free ends (no restraint), and another series with a restraint of 132,000 pound inches per radian of rotation of the fixture. An infinite restraint corresponds to fixed-end conditions. The results found so far appear satisfactory, and it is planned to continue the investigation, using different degrees of restraint and tubes of other sizes. It is expected that the results of this investigation will enable designers to reduce the weight of aircraft structures with safety.

Means for Distinguishing Steel Airplane Tubing of Different Compositions.—In cooperation with the Bureau of Aeronautics and the National Advisory Committee for Aeronautics an exploratory study was made of different methods which might be used as a rapid "nondestructive" means of distinguishing between plain carbon steel and chromium-molybdenum steel tubing—the two widely used materials of this kind in airplane construction. A magnetic method and a spark test have given very favorable results. A simple chemical "spot test" appears to be impossible.

Flat Plates Under Edge Compression.—In the pontoons or floats of seaplanes flat plates are subjected to compressive forces in the plane of the plate. Also in the fuselage of airplanes, flat plates are fitted around and riveted to the framework to form the outer covering and increase the strength. These plates are also subjected to compressive forces in their plane. In order to determine the loads such plates can carry, the bureau in cooperation with the Bureau of Aeronautics conducted an investigation of four different materials—nickel, duralumin, stainless iron, and monel metal, having thicknesses up to 0.095 inch, a length of 24 inches (direction of load) and widths up to 24 inches. The edges parallel to the direction of loading were supported in V grooves and the load was applied in a testing machine. It was found that the plates could be subjected to an increase of load after they had begun to buckle and that, especially in the thinner and wider specimens, it was possible for the plate to carry many times its theoretical buckling load under uniform thrust without permanent deformation.

Flat Plates Under Normal Pressure.—At the request of the Navy Department, an apparatus was designed and built for testing specimens representing pontoon construction by subjecting them to a normal water pressure. This apparatus is equipped to test specimens up to 30 by 90 inches. The upward deflection of the plate as it bulges under pressure can be measured at points 1 inch apart over the entire surface. Specimens of pontoons having various forms of stiffening and bracing will be tested.

Substitute for Goldbeater's Skin for Making Gas Cells of Airships.—This work, which has been in progress for several years, has been continued during the past year and various new materials which have been suggested from time to time have been tested, but most of them have proved to be unsuitable. However, one type of material is giving promising results. An application for a patent is in course of preparation.

Supercharging of Aircraft Engines.—Altitude chamber performance tests of a Curtiss D-12 engine equipped with a Roots-type supercharger, having a critical altitude of 5,000 feet at 2,000 r. p. m., were made for the Army Air Corps. Power and friction runs were made at four engine speeds and under conditions corresponding to altitudes from sea level to 25,000 feet. Tests of the same engine equipped with a geared centrifugal supercharger having a critical altitude of 15,000 feet at 2,300 r. p. m. are now in progress.

Type Testing of Commercial Airplane Engines.—The engine-testing laboratory at Arlington is operating at full capacity, and a fourth torque stand unit will be added to provide for probable increased demands. Of 52 engines received for test during the year

26 passed, 23 failed, and 3 were withdrawn. While the percentage of failures has decreased somewhat, some manufacturers have evidently submitted purely experimental engines, thus having their development work done at Government expense.

Publications.—Commercial Airplane Engines, by H. C. Dickinson, *Aero Digest*, 14, No. 4, p. 102, 1929.

Type Testing of Commercial Airplane Engines of Medium Power, by H. K. Cummings. *Trans. Amer. Soc. of Mech. Engineers, Aeronautical Engineering*, 1, No. 2, p. 45, 1929.

Reduction of Noise in Airplanes.—In cooperation with the Aeronautics Branch of the Department of Commerce, studies have been made of the possibilities of reducing noise in airplanes. A summary of the work now completed has been prepared for publication as a bulletin of the aeronautics branch.

Publication.—Silencing the Airplane, by H. L. Dryden, Paper before Fourth Aeronautical Meeting, American Society of Mechanical Engineers, May, 1930.

Aircraft Instruments.—A strut thermometer of the electric-resistance type, an improved suspended head air-speed meter of the commutator-condenser type, and a maximum indicating accelerometer were constructed for the Bureau of Aeronautics. A mooring force indicator for the airship *Los Angeles* and a suspended Pitot-static head air-speed meter are under development. Investigations to provide a basis for the specification of performance of banking indicators, magnetic compasses, and tachometers were conducted. A standard vibration board was designed and constructed for the purpose of testing aircraft instruments.

Publications.—Electrical Instruments for Aircraft, by V. E. Whitman, *Electrical Manufacturing*, p. 32, August, 1929.

Recent Developments in Aircraft Instruments, by W. G. Brombacher. *Trans. Amer. Soc. of Mech. Engineers, Aeronautical Engineering*, 1, p. 119, 1929.

Minimum Temperature Recording Strut Thermometer, by H. B. Henrickson, *Instruments*, 2, p. 323, 1929.

Flight Test Instruments, by J. B. Peterson and E. W. Rounds, *Soc. of Automotive Engineers Journal*, 26, p. 313, 1930.

Landing Altimeters.—A number of altimeters of the aneroid type were tested for drift, seasoning, secular error, and temperature errors with special reference to their use during the landing of aircraft. Flight tests were also made. When using sensitive altimeters of the best quality now available and applying such of the instrumental corrections as are determinate, a residual uncertainty equivalent to about 40 feet in altitude was found to exist.

Air Navigation Facilities—Radio.—The investigation of the use of radio in aeronautics for the Aeronautics Branch of the Department of Commerce has been continued with special emphasis on radiobeacon systems and means for blind landing. The experimental work on the 2, 4, and 12 course visual type radiobeacons was completed. The sensitivity of the vibrating reed indicator was increased fourfold. The development of a new transmitter for the simultaneous transmission of radiotelephone messages and visual type radiobeacon signals on the same radio-frequency was begun. An automatic volume control device for use in the reception of visual beacon signals was developed, thereby relieving the pilot of the duty of controlling the receiving set sensitivity.

A complete system of radio aids showing good promise for blind landing of aircraft was developed. This system includes three elements to indicate the position of the aircraft in three dimensions as it approaches the instant of landing. A low-power radiobeacon gives the lateral or landing field direction. Marker beacons give the longitudinal direction or approach. An ultra high-frequency radio beam gives the height, marking out the proper landing path. Actual blind landings were made at Mitchel Field, Long Island, N. Y., by a representative of the Guggenheim Fund, using the first two elements in conjunction with special flight instruments.

Contact and cooperation with the aircraft and radio industries in the development of engine ignition shielding was maintained. A commercial shielding assembly patterned after an assembly developed by the National Bureau of Standards met with marked success. A direction finder permitting aural or visual indication of the direction of the received signal was developed and thoroughly tested in the laboratory preparatory to flight testing.

Publications.—A Course-Shift Indicator for Double-Modulation Type Radio Beacon, by H. Diamond and F. W. Dunmore, B. S. Jour. Research, 3, No. 1, p. 1, 1929.

Applying the Visual Double-Modulation Type Radio Range to the Airways, by H. Diamond, B. S. Jour. Research, 4, No. 2, p. 265, 1930.

A 12-Course Radio Range for Guiding Aircraft with Tuned Reed Visual Indication, by H. Diamond and F. G. Kear, B. S. Jour. Research, 4, No. 3, p. 351, 1930.

Applying the Radio Range to the Airways, by F. G. Kear and W. E. Jackson, B. S. Jour. Research, 4, No. 3, p. 371, 1930.

Engine Ignition Shielding for Radio Reception in Aircraft, by H. Diamond and F. G. Gardner, B. S. Jour. Research, 4, No. 3, p. 415, 1930.

Development of the Visual Type Airway Radiobeacon System, by J. H. Dellinger, H. Diamond, and F. W. Dunmore, B. S. Jour. Research, 4, No. 3, p. 425, 1930.

A Tuned-Reed Course Indicator for the 4 and 12 Course Aircraft Radio Range, by F. W. Dunmore, B. S. Jour. Research, 4, No. 4, p. 461, 1930.

Radio Developments Applied to Aircraft, by J. H. Dellinger and H. Diamond, Mechanical Engineering, 51, p. 509, 1929.

Lighting of Airports and Airways.—Extended series of photometric measurements have been made on airway beacons with various types of lamps, reflectors, and cover glasses. Twenty-four-inch beacons, code beacons, and gaseous discharge tube beacons have been measured, and observations of their visibility have been made from fixed stations and from airplanes. Observations on several types of boundary lights have been made from two distances by 16 observers. Experiments on the lighting of wind-indicator cones have been continued, and measurements are in progress on aviation red and green signal glasses, for the purpose of preparing specifications.

Publication.—Relative Visibility of Luminous Flashes from Neon Lamps and from Incandescent Lamps With and Without Red Filters, by F. C. Breckenridge and J. E. Nolan, B. S. Jour. Research, 3, No. 1, p. 11, 1929.

AUTOMOTIVE ENGINEERING

Automobile Engine Acceleration.—From tests made in cooperation with the American Petroleum Institute, the National Automobile Chamber of Commerce, and the Society of Automotive Engineers with the portable spark accelerometer on a number of representative

automobile engines at the laboratories of the companies manufacturing them, it was concluded that the effect on acceleration of fuel volatility is qualitatively independent of engine design. For any given engine and fuel it is possible to realize practically the computed maximum acceleration over the entire speed range by using the proper carburetor setting and suitably proportioning the quantity and rate of injection of the accelerating charge. A paper marking the completion of the acceleration phase of the cooperative work on the economic volatility of motor fuels was presented at the summer meeting of the Society of Automotive Engineers.

Publication.—Fuel Volatility and Engine Acceleration, by D. B. Brooks and C. S. Bruce, Bull. Am. Petroleum Institute, 11, No. 1, Sec. III, p. 24, 1930.

Antiknock Characteristics of Fuels.—The problem of specifying the antiknock characteristics of motor fuels not only involves the general adoption of standard test equipment and procedure, but requires that fuels be rated on a common scale. Therefore, the subcommittee on methods of measuring detonation, appointed by the cooperative fuel research steering committee, with which the bureau is cooperating, has recommended that all laboratories be invited to express their present knock-rating scales in terms of "octane numbers" in order to eliminate as far as possible the confusion which results from the use of numerous unrelated and empirical scales of antiknock value. The octane number of a gasoline is defined as the number of parts by volume of iso-octane that must be added to 10 parts of normal heptane to produce a blend of equivalent detonation characteristics.

Results of tests by the eight cooperating laboratories on a group of common fuels have been analyzed, and research is in progress to improve the test equipment and to evaluate the several factors which influence the measurement of detonation. This is now the major problem of the joint motor-fuel research supported cooperatively by the American Petroleum Institute and the National Automobile Chamber of Commerce through the Society of Automotive Engineers.

Vapor Lock in Airplane Fuel Systems.—Extensive laboratory experiments show that the lowest temperature at which vapor lock is likely to occur in a well-designed fuel feed system is the temperature at which the gas-free vapor pressure becomes equal to the external pressure. Unless the gasoline contains appreciable amounts of propane this vapor-locking temperature is equal at sea level to the A. S. T. M. 10 per cent point and decreases about 2° F for each 1,000 feet altitude. The effect of weathering of the gasoline on the vapor-locking tendency has also been studied. In order to determine whether any particular gasoline is liable to cause vapor lock in existing types of airplanes, it is necessary to ascertain what temperatures are likely to exist in the fuel lines of such aircraft under various conditions of flight. Such data are being secured through cooperation with the Army, the Navy, and the National Advisory Committee for Aeronautics.

Publications.—The Properties of Gasolines with Reference to Vapor Lock, by O. C. Bridgeman and E. W. Aldrich, Society of Automotive Engineers Journal (in press).

Vapor Pressures of Gas-free Gasolines, by O. C. Bridgeman, E. W. Aldrich, and H. S. White, Bull. Amer. Petroleum Institute, 11, No. 1, Sec. III, p. 4, 1930.

Phenomena of Combustion.—Upward of 3,000 photographic records of the progress of the gaseous explosive reaction as it occurs at constant pressure in a soap bubble used as a bomb have been analyzed to determine the effect of pressure on the rate of the reaction. The experimental data, covering a variety of pure and composite gaseous fuels and a range of constant pressures from 100 to 2,530 mm of mercury, show that for a charge of given proportions the linear rate of propagation of the reaction zone within the explosive gases is constant and independent of pressure, and that as a result the rate of molecular transformation is proportional to pressure. A report presenting these results, and discussing the characteristics of the explosive reaction as they apply to its technical and industrial applications as a source of power, has been prepared and will be published by the National Advisory Committee for Aeronautics, which has cooperated with the bureau in this investigation.

Publication.—The Gaseous Explosive Reaction at Constant Pressure—The Reaction Order and Reaction Rate, by F. W. Stevens, Natl. Advis. Com. for Aero. Tech. Report No. 337, 1929.

Combustion in an Engine Cylinder.—Equipment for making stroboscopic observations of flame movement and simultaneous measurements of pressure development in an engine cylinder has been used and improved over a period of about one year and at present constitutes a promising research tool for investigating combustion in the engine cylinder. Diagrams showing the movement of the flame in all parts of the combustion chamber and the variation of pressure during burning have been obtained for a variety of engine operating conditions and a number of different gaseous fuels. Such data are of assistance in correlating the more fundamental studies of the gaseous explosive reaction at constant pressure with actual engine performance.

The work has been done in cooperation with the National Advisory Committee for Aeronautics.

Effect of Spark Character on Ignition Ability.—The relative effectiveness of ignition sparks has been compared by determining the amount of chemical reaction which takes place when different sparks are passed through an explosive mixture of oxygen and hydrogen at low-pressure and liquid-air temperature. The amount of reaction occurring when magneto sparks are passed through very lean mixtures of oxygen and hydrogen at atmospheric pressure has also been studied. Spark character was altered by varying the electrical constants of the ignition circuit. To measure spark character more precisely, a cathode ray oscillograph will be required. This work was supported jointly by the National Advisory Committee for Aeronautics and the Bureau of Aeronautics of the Navy Department.

Effect of Air Humidity on Engine Performance.—The work on effect of air humidity on engine performance, conducted for the Bureau of Aeronautics, Navy Department, has of necessity been broadened to include a study of the methods of measurement of humidity. A modified form of psychrometer has been developed which shows much higher precision than the standard types of

psychrometer. Action to obtain a Government patent will be initiated soon. This study has included the effect of wick, ventilation, temperature, foreign matter, etc., and has for its object the development of psychrometers suitable for routine as well as research work.

Engine power tests have been made, extending the range of humidity from 1 to 80 mm mercury pressure of water vapor. These tests accord with the oxygen content hypothesis. A paper describing the results of study of the effect of humidity on detonation was published. Results indicate an increase in effectiveness of tetraethyl lead as a knock suppressor at increased humidities, this increase being as much as 25 per cent for the normal annual variation of the moisture content of the air. Especial attention was given to the possibility of changes of humidity causing error in knock rating.

Publication.—Correcting Engine Tests for Humidity, by D. B. Brooks, B. S. Jour. Research, 3, No. 5, p. 795, 1929.

BUILDING AND HOUSING AND BUILDING CONSTRUCTION

Wind Pressure on Structures.—Additional measurements of wind pressure have been made on the stack of the bureau's power plant, and a paper has been prepared giving all of the information available on the wind pressure on circular cylinders and chimneys.

Measurements of the distribution of wind pressure over a model of one type of factory building at several angles to the wind have been completed in the 10-foot wind tunnel.

The wind force on a model of a wooden oil derrick has been measured.

Acoustic Properties of Building Materials.—Public interest in sound absorbing materials for the correction of acoustics of auditoriums still continues, and the bureau's facilities for measurements of this character are in constant requisition. A new method was tried by which such measurements are taken by means of instruments, eliminating the variable human ear as a factor. Complete success, however, was not attained. The study of soundproof walls for airplane cabins has been continued, and some 20 combinations have been tested. None of these have given better results than those tested last year and described in the Bureau's Journal of Research for May, 1929.

Publication.—Architectural Acoustics, B. S. Circular No. 330, 1930.

Plumbing Systems.—An extension of the plumbing investigation carried out in 1921-1923 for the Building Code Committee of the Department of Commerce has been undertaken in cooperation with the industry to include pipe sizes and design of systems for tall buildings.

Preliminary observations and measurements were made on (1) the capacities of drains, and (2) the loads carried by the drains under actual service conditions in five large buildings in New York City and in two of the larger Government office buildings in Washington. Other data pertaining to the loads on plumbing systems in actual service were obtained. An extensive experimental program is planned for the current year.

Building Codes.—Work has been continued on consolidating the reports previously issued, and on additional recommendations for

fire resistant construction and other subjects, in order to provide a comprehensive framework of minimum requirements.

Publication.—Building Code Committee of the United States Department of Commerce, by W. K. Hatt, Engineering News Record, 104, No. 23, p. 926, 1930.

Combustible Contents of Buildings.—A survey of the amount and character of combustible contents of typical fire-resisting buildings in Washington was made as an aid in classification from the fire-hazard standpoint.

Experimental work to determine the inherent fire hazard and protection required for household-heating appliances was nearly completed. This was preceded by a survey of existing conditions in residences and apartments and examination of premises where fires from stoves, furnaces, and their pipes have occurred.

City Planning and Zoning.—Surveys of city planning and zoning laws and ordinances showed further progress in the use of the bureau's recommendations. A pamphlet on the preparation of zoning ordinances was prepared.

Construction Economics.—An extensive study was made of the planning and control of public works, and since December, 1929, several members of the bureau's staff have aided in the department's work of coordinating the activities of Federal, State, and local officials in expediting public works construction. This was part of the general program aiming to sustain business and employment activity.

Home Financing.—A preliminary report has been written on the basis of field work regarding the volume of mortgage writing and cost of administration.

Survey of Small House Construction.—A digest of data obtained through a field survey made last year in 31 cities has been prepared for publication.

Care and Repair of the House.—A handbook for home owners and those interested in keeping their property in good condition was prepared. It gives simple and specific directions for home repair work and describes tools and materials needed.

Cooperation with Other Agencies on Building and Housing Problems.—Cooperation was continued with Federal and State agencies and with thousands of local governments and private organizations concerned with building and housing. City planning and zoning, building codes, and home-ownership problems were taken up jointly with bodies, such as Better Homes in America with its 6,500 local committees and organizations, representing architects, engineers, business, civic, and other groups.

CEMENT AND CONCRETE

Durability of Concrete Aggregates.—A study completed during the year indicates that no one test is suitable for determining the durability of concrete aggregates exposed to freezing and thawing. Of the three tests used, it has been found, in general, that one of the tests is more suitable for each of the various types of material. Petrographic analysis may be used to advantage in determining the

merits of the aggregates. The presence of clay in certain forms, such as laminae, appears to be the cause of early disintegration in certain types of rock.

Concrete Masonry Units.—Tests have been made on 50 different samples of concrete masonry units, from 17 different States. Included in these were units made from the common aggregates—sand, gravel, limestone, haydite, cinders, and slag.

The compressive strengths varied from 400 to 2,000 pounds per square inch of gross area. From the data obtained there seemed to be no apparent relation between the absorption and the compressive strength except that usually the sand units had the greatest strength and least absorption while the cinder and haydite blocks had less strength and a greater capacity for taking up water.

The weights of the different types proved to be markedly different, the sand blocks varied from 125 to 150 pounds per cubic foot. The cinder units had weights per cubic foot of from 70 to 100 pounds. Haydite were the lightest ranging between 70 and 85 pounds per cubic foot.

A federal specification has been prepared for the concrete masonry unit.

Clays as Admixtures in Concrete.—In cooperation with an engineering firm, an investigation of the value of clay admixtures in concrete has been undertaken. Beginning with a concrete mixture containing five sacks of cement per cubic yard of concrete, the effects of substituting clay, either for 10 per cent of the volume of the cement or for $7\frac{1}{2}$ per cent of the volume of the fine aggregate, on the strength and permeability of the concrete are being determined.

Test of Large Concrete Cylinders.—As a part of the studies being made by engineers of the Aluminum Co. of America in connection with the design and construction of dams, twenty-three 24 by 48 inch concrete cylinders were fabricated and sent to the bureau for testing. The values obtained for Poisson's ratio are of general interest, since but few measurements on large specimens had been made previously. It was found that Poisson's ratio for the concrete was about 0.15 for all stresses within the range from 0 to 1,000 pounds per square inch.

Tests of the Arlington Memorial Bridge.—Tests of the Arlington Memorial Bridge have been continued, with the cooperation of the Arlington Memorial Bridge Commission. Continuous records of the temperatures of the concrete in one of the main arch spans are being obtained. During the year the average temperature of the arch has varied between 28° and 80° F. with portions covering ranges nearly as great as for the surrounding air. In addition, measurements were made of the deformations and deflections of the arch barrel due to temperature changes, both before and after the construction of the walls and roadway, to determine the effect of the restraint of the superstructure on the deformations of the arch.

Reaction of Water on Calcium Aluminates and Calcium Aluminate Cements.—During the past year the study of the mechanism of the reaction of water on one domestic and seven foreign calcium aluminate cements, together with that on the ternary compound $4\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot \text{Fe}_2\text{O}_3$, has been completed. It was found that these

cements, together with the three anhydrous calcium aluminates less basic than tricalcium aluminate previously investigated, reacted with water to form a metastable solution in the early periods which approximated the composition of monocalcium aluminate. The boundaries fixing the region wherein these metastable solutions occur in the phase system $\text{CaO-Al}_2\text{O}_3\text{-H}_2\text{O}$ have been determined. The metastable solutions decompose as the reactions proceed with the precipitation of varying amounts of hydrated alumina and crystalline hydrated tricalcium aluminate. An investigation of this system has been undertaken to find out what are the phases occurring in the system $\text{CaO-Al}_2\text{O}_3\text{-H}_2\text{O}$.

Phase Study of the System $\text{CaO-SiO}_2\text{-B}_2\text{O}_3$.—A study of a portion of the $\text{CaO-SiO}_2\text{-B}_2\text{O}_3$ system is being made, in an attempt to determine the effect of B_2O_3 on the formation and the properties of the calcium silicates. It has been found that the presence of small amounts of B_2O_3 in dicalcium silicate lowers the refractive index, and also lowers the temperature of the inversion from the beta to the alpha form.

Cast Stone.—All tests other than freezing and thawing have been completed on 60 samples of cast stone obtained from sources well distributed throughout the United States. Some very unusual characteristics were exhibited by the samples. The modulus of rupture ranged up to 1,500 lbs./in.² with a low value of 200 lbs./in.² The compressive strength of the three strongest specimens was over 20,000 lbs./in.², the best specimen giving a strength of 23,000 lbs./in.² This contrasted with a minimum strength for all specimens of 1,500 lbs./in.² The maximum 48-hour absorption was 13.5 per cent. A minimum value of 2 per cent was obtained from one specimen. The resistance to freezing and thawing ranged from complete failure of the specimen within 40 cycles to those specimens that exhibited no signs of disintegration at 500 cycles.

Diatomaceous Silica.—Tests of the effect of the addition of diatomaceous silica to concrete have been made, using 14 samples submitted from different producers and including material widely separated geographically. The materials ranged from 7.5 to 34.7 pounds per cubic foot; most of the material submitted was composed very largely of diatoms, although some samples contained appreciable amounts of clay and other foreign substances.

It has been found that the addition of diatomaceous silica requires the use of more mixing water, the lighter the silica the more water required. For concretes of equal flows the strengths are not appreciably different, the diatomaceous silicas tending to produce a lower strength. It was found that the addition of diatomaceous silica permitted a larger flow without the separation of the constituent materials of the concrete.

A Federal specification for this material has been prepared.

Waterproofing Compounds.—A study of 100 commercial damp-proofing and waterproofing compounds for use with concrete shows a marked difference in their effectiveness over a period of one year.

Concrete test specimens containing integral waterproofing compounds subjected constantly to a 20-pound water pressure show in most cases only a slight permeability at the end of one year.

These test specimens, however, after drying in the air of the laboratory for one month show in most cases a decided increase in permeability.

Surface treatments vary greatly in merit when kept under water continuously. At the end of a year the majority were of little value. About one-third of the specimens were considered to be sufficiently effective for practical use.

Cement Reference Laboratory.—The cement reference laboratory, a cooperative project of the National Bureau of Standards and the American Society for Testing Materials, in the first year of its existence studied the standardization and improvement of the methods of testing cement. During that time the efforts were chiefly concentrated on field work, inspections being made at 175 laboratories. These inspections include the testing of apparatus, demonstration of methods, and the collection of miscellaneous data. The information collected during the year is proving valuable in outlining further work of the laboratory. There have been received requests for the inspection of 194 laboratories, indicating a widespread interest in this work.

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 testing concreting materials, and the San Francisco laboratory making miscellaneous chemical and physical tests. During the year cement inspection service was established at six cement plants. During the year 1,628,187 barrels were sampled and tested and 1,255,947 barrels shipped to Government projects.

CERTIFICATION AND LABELING

Facilitating the Use of Specifications.—In order to facilitate the use of Federal specifications and commercial standards by governmental purchasing agencies, there has been sent to these agencies, lists of sources of supply of commodities covered by 281 of these specifications and standards in the form of names and addresses of manufacturers desirous of supplying material certified by them as complying with the requirements of the specifications and standards.

As shown by the accompanying table, about 9,000 separate requests for listing as willing to certify have been received from more than 3,000 manufacturers.

The certification plan for facilitating the use of nationally recognized commodity specifications is fully approved by governmental and institutional purchasers, Federal, State, county, and municipal. Many associations representing producers and distributors, as well as consumers, are cooperating actively in making the plan effective. Correspondence conducted with the officers of all known American technical societies and trade associations has shown that technical societies familiar with the formulation of specifications look with favor upon the certification plan as an effective method of bringing specifications to the attention of the interested producers and consumers. With few exceptions, the officers of trade associations are also favorably inclined toward it.

Statistical summary of willing-to-certify lists as applied to Federal specifications and commercial standards

| Commodity groups | Total number of— | | |
|---|---------------------|----------|-------|
| | Specifi- cations | Listings | Firms |
| Abrasives and polishing materials..... | 9 | 113 | 54 |
| Brick, common..... | 1 | 200 | 200 |
| Brushes and brooms..... | 48 | 945 | 179 |
| Builders' hardware..... | 1 | 33 | 33 |
| Cement, Portland..... | 1 | 69 | 69 |
| Commercial standards..... | 10 | 233 | 199 |
| 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 |
| Heat-insulating materials..... | 8 | 58 | 30 |
| Inks..... | 6 | 114 | 43 |
| Leather goods..... | 4 | 103 | 81 |
| Lime and plaster..... | 4 | 145 | 87 |
| Liquid-measuring devices..... | 1 | 21 | 21 |
| Lumber, softwood..... | 1 | 500 | 500 |
| 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 | 105 |
| Rope, wire..... | 1 | 15 | 15 |
| Safes, burglar-resisting..... | 1 | 3 | 3 |
| Scales, railroad track..... | 1 | 7 | 7 |
| Scales, weighing..... | 1 | 33 | 33 |
| Screws, wood..... | 1 | 14 | 14 |
| Scaps and scouring compounds..... | 13 | 562 | 158 |
| Tableware, silver-plated..... | 1 | 7 | 7 |
| Textiles..... | 33 | 598 | 191 |
| Tubing, metallic..... | 4 | 61 | 49 |
| Total..... | 281 | 8,945 | 3,091 |

CHEMISTRY

The Molecular Weight of Hydrocarbons.—An improved Victor-Meyer apparatus has been designed and constructed. By making two determinations, one at 1 atmosphere and the other at 0.5 atmosphere, it is possible to determine the molecular weight with an accuracy of about 0.3 of a unit.

Measurement of Diophantine Quantities.—Quantities such as the molecular weights of hydrocarbons are diophantine quantities because the possible values of the quantity measured do not form a continuum, as is the case with most physical quantities. The principles of measurement and of calculation for such quantities present features quite different from those ordinarily associated with physical measurements. These principles have been elaborated and applied to a number of problems.

The Phase Equilibrium Diagram for the System $\text{Cr}_2\text{O}_3\text{--SiO}_2$.—The diagram has been determined and is characterized by complete nonmiscibility of the two components in the liquid state. The melting point of Cr_2O_3 has been determined in an oxidizing atmosphere

and found to be $2,140^{\circ}$ C., a value materially higher than any previously reported.

The Chloroplatinate-Chloroplatinite Electrode.—The emf. of this electrode has been found to correspond to a reversible chemical equilibrium. The emf. has been measured and the free energy of the reaction determined.

Application of the Glass Electrode for pH Measurements.—The degree of acidity, commonly expressed as pH, is important in many chemical processes, including electroplating. The methods previously used, especially the hydrogen and quinhydrone electrodes, and colorimetric indicators are not applicable in the presence of oxidizing agents. Results thus far obtained indicate that the "glass electrode" may be applicable to chromic acid baths and other oxidizing solutions.

Methods for Silvering Glass.—Letter Circular No. 32, giving methods for silvering glass, has had a very wide circulation, approximately 200 copies having been distributed each year on individual requests since it was prepared in 1919. In connection with the preparation of a new circular, considerable work has been done in refining and improving the technique and simplifying the formulas in order to make success in their use more certain and less dependent upon previous experience. The new circular, of which the manuscript is now complete, gives methods for the chemical deposition of silver, copper, platinum; and lead sulphide, and for the production of mirrors by cathode sputtering and by the condensation of metallic vapors on glass.

Chemical Testing and Methods of Analysis.—Many samples of structural materials were tested for various branches of the Government. Analyses of Portland cement, cast irons, steels, alloy steels, ferro-alloys, brasses, bronzes, bearing metals, boiler plugs, Monel metal, and light aluminum alloys were made to aid in the development of specifications, to insure proper delivery of materials, to detect causes of failure in service, and to determine the composition of materials used in metallurgical researches carried on at the bureau. Improved and more rapid test methods were developed as, for example, an improved persulphate method for the determination of manganese in cast iron and steels and a more rapid and accurate method for the determination of fluorine and of silica in glasses and enamels containing fluorine.

Cooperation with the American Society for Testing Materials.—The bureau cooperated extensively with the American Society for Testing Materials in the preparation of methods of analysis for steels, cast irons, and various paint materials, in the preparation of specifications for sampling sheet steel and ferro-alloys, and tentative specifications for glazier's putty, in exposure tests on the stability of foundry coke, and in investigative work on the determination of the hiding power of paints and pigments and the tinting strengths of pigments.

Analytical Reagent Chemicals.—Fifty-seven individual methods for the determination of various impurities in 30 reagent chemicals were studied and in many cases modified or replaced by better methods. As in other years this work formed a substantial part of the preparation of specifications for reagent chemicals by the American Chemical Society.

Laboratory for Microscopy.—This laboratory, in addition to rendering a varied type of microscopic service to other laboratories of the bureau, is engaged in a systematic study of the crystallographic properties of organic compounds suitable for identification purposes. Most of the time during the past year has been spent in securing and assembling the necessary apparatus and preparing and standardizing a set of immersion liquids. A novel type of equipment for investigating crystalline substances at very low temperatures has been designed and constructed.

Distribution of Standard Samples.—During the year 7,592 samples were distributed, having a sales value of \$16,764, and approximately \$73,073 worth of standard samples were added to the salable samples on hand. 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.

Polishes and Cleaners.—Information was collected and made available on the preparation and uses of various types of polishes. A circular of information on washing and cleaning materials and their applications was also prepared.

CLAY AND SILICATE PRODUCTS

Factors Affecting the Crazing of Semiporcelain Dinnerware.—The use of the autoclave has won widespread, and apparently well-merited, favor in the study of this problem. Investigations of a fundamental nature are being made to determine the effect of composition and physical structure on changes in volume, as produced by reactions of water-permeable bodies with moisture, as well as the nature of the reaction itself. Values obtained indicate that bodies of more than 2 per cent water absorption will undergo a sufficient change in volume when subjected to moisture for short periods of time in an autoclave, or to atmospheric moisture over long periods of time, to rupture or craze a glaze coating. Evidence further indicates that feldspar may undergo greater volume changes than clay matter and that a temperature of at least 240° C. is required to remove the moisture causing this change in volume and to complete the accompanying volume contraction. Treatment in the autoclave, using water at approximately 150 pounds per square inch pressure and 185° C, may prove of further advantage in approximating the water absorption of semivitreous whiteware. Values obtained with 16 brands of commercial ware indicate that a 10-hour autoclave treatment as described will produce as much absorption as 240 hours of boiling in water under atmospheric pressure and that even these treatments may not fill more than 80 to 90 per cent of the total pore space.

Publication.—Effect of Water on Expansions of Ceramic Bodies of Different Composition, by H. G. Schurecht and G. R. Pole, B. S. Jour. Research, 3, No. 2, p. 331; 1929.

Cutlery Marking of Chinaware.—The attention of the bureau having been directed a number of times to the permanent marking of tableware with such objects as silver-plated knives, a preliminary investigation was conducted to determine its cause and prevention. The data obtained indicated the marking to be due to the formation of an extremely thin layer of lead sulphate on the surface of the glaze during the manufacture of the ware. One manufacturer was able to produce ware no longer susceptible to this cutlery marking by substituting an electrically heated muffle for the firing of his decorated ware.

Publication.—Cutlery Marking of Chinaware, Technical News Bulletin No. 153, p. 1, January, 1930.

Improved Apparatus for Testing Chinaware.—A final report presenting an extensive series of tests with a modified apparatus for testing the resistance of chinaware to impact and chipping has been published.

Publication.—Comparative Tests of Chinaware Using Two Forms of Testing Machine, Bull., Am. Ceramic Soc., 12, No. 11, p. 716, 1929.

Standard Classification of Feldspar.—A tentative commercial standard classification has been established mutually acceptable to users and distributors of feldspar. The suggested specification is of interest, since it is entirely technical in nature and the investigation of 19 commercial feldspars which has been carried on for several years and is now completed was productive of results of great value in the development of this specification. The final report of the investigation has been completed, but is not as yet available for publication.

Publication.—Standardization of Feldspar Classifications, Technical News Bulletin No. 153, p. 1; January, 1930.

Study of Fire Clays.—Data obtained on 26 fire clays representative of all the important mining districts in the United States show that their thermal expansions after firing at $1,400^{\circ}\text{C}$. may be greater or less than after firing at $1,155^{\circ}\text{C}$., depending entirely on their composition. The moduli of elasticity and rupture of the clays are, with few exceptions, greater after firing at $1,400^{\circ}\text{C}$. than after firing at $1,155^{\circ}\text{C}$., and a comparison of the values obtained on clays fired at either of these temperatures and tested at 550°C . with those obtained at atmospheric temperature, shows, in general, that the percentage increase in these values is greater in highly siliceous clays than in aluminous clays. The plastic deflections of the clays measured at $1,000^{\circ}\text{C}$. are much lower for those fired at $1,400^{\circ}\text{C}$. than those fired at $1,155^{\circ}\text{C}$. and are also less in the siliceous type of clays than in the aluminous.

Publication.—Progress Report on Investigation of Fire-Clay Bricks and the Clays Used in their Preparation, by R. A. Heindl and W. L. Pendegrast, B. S. Jour. Research, 3, No. 5, p. 691; 1929.

Thermal Dilatation of Special Refractories from 20° to $1,800^{\circ}\text{C}$.—Determinations of the thermal expansion characteristics before and after heating to $1,800^{\circ}\text{C}$. have been made on periclase, electrically fused magnesite, spinel, mullite, silicon carbide, fused alumina, bauxite, diaspore, zirconia, and graphite.

Problems Relating to Saggers.—To determine to what extent the porosity of a burned fire-clay sagger affected its life in service a series of saggers was prepared from 17 bodies and burned at three temperatures to obtain a desired range in porosity. The results obtained show that the life of saggers made from individual bodies is directly related to comparatively small changes in porosity, but because of the importance of various other properties, which also have been determined, the porosity of a series of different bodies apparently does not bear an important relation to their life when subjected to thermal shock.

Publication.—Preparation of Experimental Sagger Bodies According to Fundamental Properties, by R. A. Heindl and L. E. Mong, B. S. Jour. Research, 3, No. 3, p. 419; 1929.

Survey of Common Brick.—In cooperation with the Common Brick Manufacturers Association samples of brick from about 200 plants are being tested to determine their compliance with specifications. The tests will include other measures of quality than those ordinarily specified, in order that information useful in revising specifications may be obtained.

Publication.—Some Absorption Properties of Clay Bricks, by L. A. Palmer, B. S. Jour. Research, 3, No. 1, p. 105; 1929.

Transmission of Water Through Brick Masonry.—One phase of the study of the transmission of water through brick masonry has been completed and the results indicate that the durability of bond between brick and mortar may be improved by finding and using mortars which, under any conditions, undergo relatively small volume changes. From this standpoint various mortars are being studied and it is indicated that there are several possibilities by means of which bond durability may be improved without any material increase in labor or building cost.

Resistance of Metals to the Abrasive Action of Plastic Clay.—The investigation of the wearing qualities of various metals and alloys of steel and copper has contributed information useful to everyone interested in the resistance of metal to brasion. Comparative wear values of 12 metals and alloys have been studied. Some of these possess outstanding wear-resisting qualities, such as the chrome-nickel-tungsten composition which was used in this investigation as unity in comparing the loss in weight due to abrasion of the following alloys:

| | |
|-------------------------------------|-------|
| Carbon-cobalt-chromium | 2.3 |
| Average for several cast irons..... | 30.9 |
| Carbon-chromium-nickel steel..... | 39.1 |
| Electrolytic copper..... | 161.0 |
| Manganese-zinc bronze..... | 276.8 |

Metals that are case-hardened are not suitable for continuous abrasive resistance. As soon as the outer layer is worn away, the successive layers become less wear resisting and approach that of the softer untreated core.

Hollow-ware Dies.—Having concluded the work on brick dies, the investigation continued with a study of the effect of length and taper of cores and die on power consumption and quality of product. Experiments are also being conducted on a wide range of clays used in making hollow ware.

The trend of the information is well defined, showing that within reasonable limits both "core" and "die" length have a more marked effect on power consumption than taper, without a proportional improvement in the column structure. Hollow-ware dies that are too short produce columns with serious defects, such as torn corners and transverse cracks. It has been found that taper affects the column structure more than it does power consumption and rarely should be less than 3° for both cores and die.

A study of 4-die lubricants indicates that compressible lubricants such as steam and air, which are capable of being applied at pressures approximating that of the clay as it slides through the die, are far more efficient, easier to control, and less liable to damage the product than liquids, such as water and oil.

Publication.—Studies of Machines for Extruding Clay Columns, by P. G. Grunwell, *Ceramic Age*, 14, No. 3, p. 101; 1929.

Properties of Architectural Terra Cotta.—In cooperation with the National Terra Cotta Society, the investigation of terra cotta was continued, the work in general consisting of an inspection of about 190 buildings containing terra cotta, in order to determine the serviceability of this ware. Laboratory research is being conducted to improve the structure of terra cotta and to develop better methods of manufacture and setting.

Moisture Expansion of Ceramic Bodies.—The effects of the composition of some ceramic bodies on their moisture expansions were investigated. With the exception of mixtures containing blast-furnace slag or magnesite, most of the bodies with high absorptions developed considerable expansion. Bodies with low absorptions composed of pure clay and feldspar developed practically no moisture expansion while those composed of clay, feldspar, and more than 20 per cent silica developed considerable moisture expansion. By adding magnesite, the resistance of a ceramic body to moisture expansion was improved. Additions of whiting, iron oxide, and titanium oxide were not as beneficial as magnesite.

It was found that crazing caused by moisture expansion of bodies can usually be prevented by proper manufacturing control.

Columbus Laboratory.—Results of experimental work on 118 glazes and glasses have been published. With the values given in the paper it is possible to approximate by calculation values of tensile strength, Young's modulus of elasticity, and the mean linear coefficient of expansion of a glaze in the temperature range from 25° C. to the lower limit of the critical range. The investigation of representative English and domestic china clays and kaolins is nearing completion, the work having been amplified to cover the effects of these materials in representative white-ware bodies and to correlate other physical qualities with the amount of colloidal material inherent in the clay. The separation and study of colloidal material has also been applied to the investigation of representative alluvial and glacial clays, the data indicating that slacking time, tempering water, drying shrinkage and "green" modulus of rupture tend to increase with increase in the quantity of colloidal matter. A simple method of attack has been developed and successfully applied to the study of the relative resistance of refractories to slag attack in boiler settings. The technique consists in placing sintered slag in a quarter-inch hole drilled

in a small piece of the refractory to be tested and heating this specimen at a temperature, and for a length of time, predetermined as most appropriate for the slag and refractory in question. The specimen is then quenched in mercury and the products of the reaction studied petrographically.

Publication.—The Influence of Chemical Composition on the Physical Properties of Glazes, by F. P. Hall, J., Am. Ceramic Soc., 13, No. 3, p. 182; 1930.

COLORIMETRY AND PHOTOMETRY

Standards of Candlepower.—Four blue glass photometric filters that had already been measured at the Physikalisch-Technische Reichsanstalt and the National Physical Laboratory were measured by three independent methods, and complete reports were submitted to the cooperating laboratories in England, France, and Germany. The glasses have been forwarded to France for measurement at the Laboratoire Central d'Electricité. Carbon-filament standard lamps have also been sent to the national laboratories of England, France, Germany, Union of Socialist Soviet Republics, and Japan for international check measurements.

Filters for the Reproduction of Sunlight and Daylight and the Determination of Color Temperature.—An extensive series of filters reproducible from chemical specification has been developed for use in photographic sensitometry, colorimetry, and photometry. One has been recommended for adoption as a standard of artificial sunlight by the Seventh International Congress of Photography. Others are being considered for adoption as standards by the subcommittee on colorimetry of the International Commission on Illumination. A paper fully describing the filters is ready for publication.

Theory of Reduction of Mixture Data in Colorimetry.—The measurement of the physical properties which determine the colors of reflective and transmissive materials is the first requisite in the measurement of their colors. The second requisite is a set of standard data which give the properties of the average normal eye. A paper on the mathematical treatment of these data has been published.

Publication.—Reduction of Data on Mixture of Color Stimuli, by D. B. Judd, B. S. Jour. Research, 4, No. 4, p. 515; 1930.

Standardization of Lovibond Glasses.—During the year 225 Lovibond red glasses submitted by users have been compared with the bureau's standard glasses. In addition, 36 glasses submitted by the makers, Tintometer (Ltd.), of England, and 19 belonging to the American Oil Chemists' Society were compared with the standards. A paper describing the results obtained in grading 1,000 red glasses is in preparation.

New Color Comparator for Incandescent Lamps.—The experimental conditions affecting accuracy of comparison of two colors have been studied, and a comparator designed for incandescent lamps has been constructed which embodies to a high degree those observing conditions which are favorable to the detection of nearly imperceptible color differences. It has been found that the precision is about double that obtainable with any comparator previously used.

COMMERCIAL STANDARDS

Scope of Work.—This classification covers standards of grade, quality, measurement, tolerances, and other specification requirements established voluntarily by industry as a basis for marketing and certifying various commodities. In cooperation with the Bureau of Foreign and Domestic Commerce provision is made for the translation of commercial standards into foreign languages as a basis for promoting export trade.

Five general conferences were held, covering the following subjects: Plain mohair upholstery plush, red cedar closet linings, plate-glass mirrors, interchangeable ground glass joints, and feldspar.

A satisfactory majority of acceptances have been received, according to estimates from industries concerned, and the success of the following 16 projects has been announced: Diamond core drill fittings, plain and thread plug and ring gage blanks, builders' hardware (nontemplate), builders' template hardware, dress patterns, men's pajamas, foundry patterns of wood, standard screw threads, special screw threads, standard weight malleable iron or steel screwed unions, feldspar, interchangeable ground glass joints, domestic and industrial fuel oils, hickory golf shafts, wall paper, and staple vitreous china plumbing fixtures.

Standards Issued in Printed Form.—The 12 following commercial standards have been issued in printed form: Wrought-iron pipe nipples (CS6-29), standard weight malleable iron or steel screwed unions (CS7-29), builders' template hardware (CS9-29), brass pipe nipples (CS10-29), regain of mercerized cotton yarns (CS11-29), domestic and industrial fuel oils (CS12-29), dress patterns (CS13-30), men's pajamas (CS15-29), wall paper (CS16-29), diamond core drill fittings (CS17-30), hickory golf shafts (CS18-29), and foundry patterns of wood (CS19-30).

DENTAL MATERIALS AND METHODS

Dental Research.—This research has been continued in cooperation with the American Dental Association. The association has contributed personnel and materials to the extent of \$10,000 and is planning an increased expenditure during 1931.

The bureau has tested Government purchases of dental golds, amalgam, alloys, etc., having an estimated value of \$100,000. About half this amount has been rejected as unfit for use in service. Replacements have been made and approved. The savings resulting from the elimination of this defective material can not be accurately computed as they include: (a) Time of operator making restoration, (b) length of service of defective material, (c) health of patient receiving defective material, and (d) imperfection of service from defective material.

Specifications have been prepared for dental investments, and a thorough test made of all investments on the market. These tests show at least one-half of the brands to be unsuited for use in dental laboratories.

Assistance has been given dental schools, manufacturers, and testing laboratories interested in equipping for this type of research.

Lectures and clinics have been given in Washington, New York, Boston, Des Moines, Chicago, and Columbus.

One of the most satisfactory aspects of this program is the move by a number of manufacturers to guarantee certain of their products to comply with the specifications adopted by the American Dental Association through cooperation with the bureau.

Publications.—Some laboratory Experiments for the Dental School, by Wilmer Souder, J. Am. Dental Assn., 16, No. 10, p. 1829; 1929.

A Specification for Dental Amalgam Alloys, by N. O. Taylor, J. Am. Dental Assn., 17, No. 1, p. 112; 1930.

Progress Report on Research on Dental Materials (II), the Research Program, by N. O. Taylor, J. Am. Dental Assn., 17, No. 5, p. 775; 1930.

Tentative Specifications for Dental Casting Investment, by Wilmer Souder and W. T. Sweeney, J. Am. Dental Assn., 17, No. 5, p. 780; 1930.

ELECTRICITY

Ratios of International Electrical Units to Absolute Units.—Experimental work necessary for the establishment of electrical units on the absolute basis has been continued. With the Rosa-Dorsey-Miller current balance as reconstructed during the past two years it is possible to measure the absolute value of an electric current with an accuracy of a few parts in a million. A considerable number of measurements have been made to determine the value of the international ampere in absolute units, but no final value has been reached. Another type of apparatus for the absolute measurement of current, known as the Pellat current balance, has been designed and partially constructed.

The value of the ohm can most readily be established through measurements of inductance (henries) in terms of resistance standards. The value of the inductance of a solenoid can be determined in absolute henries from its mechanical dimensions. The value of the inductance in international henries can be measured in terms of the international ohm and second. Measurements have been nearly completed on a solenoid wound on a porcelain cylinder, and two additional solenoids have been constructed, one on a pyrex glass form, the other on a fused quartz form. These last two solenoids have been made with extreme care and every precaution is being taken in the measurements, with the expectation that the final result will be accurate within 1 part in 100,000.

Standards of Electromotive Force.—Improvements have been made in the standard cell equipment, including the design and construction of a new laboratory room especially adapted to the purpose. Additional space has been provided for the increased amount of testing now required, refrigeration is available for holding the temperature of the baths to a constant value in summer and a new and better oil-bath has been constructed for the cells which constitute the primary standard. In moving the primary standard group from its old location no perceptible change in its values has been introduced, check measurements in the old and new locations agreeing on the average to within four ten-millionths of a volt. Several comparisons have been made with the national laboratories of England, Germany, and Japan. Complete data are not available in all cases, but the results indicate the same relative standing of the units as before.

Intercomparison of Resistance Standards.—Three resistance standards from the National Bureau of Standards were measured at the British and German national laboratories. The results indicate that the unit of electrical resistance as maintained by the three laboratories is in agreement within 2 or 3 parts in 100,000. The standards used in these intercomparisons were of the new type recently developed at the National Bureau of Standards. They apparently remained very constant in resistance during shipment, thus giving a more accurate intercomparison than any that had been made previously.

Measurement of High Voltages and Large Currents.—The large absolute high voltage electrometer which has been under construction for several years was operated in some preliminary trials at 90,000 volts, and showed the expected sensitivity. The disturbing effects of air currents proved to be very serious, but modifications have been made which greatly reduce these disturbances. A special microscope has been constructed for accurately determining the location of the attracted disk relative to the guard ring.

A standard current transformer and accessory apparatus which have been completed raise the possible range of testing from 2,500 amperes to 6,000 amperes. Tests have already been made for the public at 4,000 amperes. The small capacity of the motor-generator sets available is now the only limitation which prevents testing current transformers up to 12,000 amperes.

Dry Cell Standardization.—The qualification tests made primarily in connection with Government purchases have been continued, and have included samples from practically all makers of dry cells in this country. The mechanical equipment for controlling the tests makes it possible to test a large number of batteries with a minimum amount of labor. Results of these tests have served as a basis for a revision of the American standard for dry cells and also for a revision of the Federal specification. Both of these projects were practically complete at the close of the year. Experimental work to determine the proper conditions for testing the new type of industrial flashlight batteries has been in progress.

Specifications for Storage Batteries.—Automotive storage batteries are now covered by a specification which was completed and ready for transmission to the Federal Specifications Board at the close of the year. Progress has been made in the preparation of a standard specification for sulphuric acid and battery electrolyte.

Corrosion of Storage Battery Plates.—Corrosion of the positive plates in certain submarine batteries has led to a study of the effects of organic material in such batteries and the conditions under which corrosion of the plates may occur. Conflicting evidence regarding the rôle of acetic acid in storage batteries has been explained, and a method for the determination of small amounts of acetic acid in the presence of large amounts of sulphuric acid has been developed.

Storage-Battery Construction and Operation.—Attention has been devoted to the use of lead oxides whose physical and chemical properties have been the subject of previous study. Experimental work has been done on pasting formulas, pickling and formation of storage battery plates. Batteries have been assembled from these plates and tested for electrical characteristics. Equipment for the

automatic control of such tests, by which it is hoped to increase the output but decrease the labor of making the tests, has been designed.

Properties of Electrical Insulating Materials.—The study of the electrical properties of rubber has been continued, and a new research on the electrical properties of insulating liquids has been started. An entirely new phenomenon has been discovered in connection with rubber insulation which shows that the electrical properties slowly change with time when there is a sudden change in temperature or pressure. Four insulating liquids of high purity have been prepared, namely, pentane, hexane, heptane, and octane. Apparatus for measuring the conductivity of liquids after distillation in a vacuum has been assembled and tested.

Magnetic Testing and Research.—An investigation on the standardization of magnetic permeameters was completed. Work was also done on testing with intense fields and on testing with alternating currents at low inductions.

In the field of magnetic analysis, experiments were carried out on the relation between magnetic properties and impact strength and a study of the phenomena associated with the tempering of heat treated bridge wire was started, using the methods of thermomagnetic analysis.

Publications.—Standards for Testing Magnetic Permeameters, by R. L. Sanford, B. S. Jour. Research, 4, No. 2, p. 177; 1930.

Performance of the Fahy Simplex Permeameter, by R. L. Sanford, B. S. Jour. Research, 4, No. 5, p. 703; 1930.

FIRE RESISTANCE

Spontaneous Heating and Ignition of Materials.—Determinations of ignition temperature and susceptibility to spontaneous heating of a wide range of materials have been made at the request of other Government departments. The methods employed have not been considered fully satisfactory, nor are the results always conclusive, and during the year preliminary work that should lead to more fundamental methods was undertaken. A summary of the existing state of knowledge on the subject was presented at a conference sponsored by the National Fire Protection Association and the Departments of Agriculture and Commerce.

The susceptibility of jute to spontaneous heating and ignition is being studied in cooperation with the Bureau of Chemistry and Soils and a committee of the marine underwriters. For the physical tests four heating chambers have been built at the National Bureau of Standards, each accommodating a bale of jute 20 by 20 by 50 inches. These chambers are equipped to maintain temperatures up to 250° C., with the humidity control for temperatures below 80° C. The testing procedure involves maintaining chamber temperature a little below that of the bale, where heating of the latter from bacteria or other cause develops. Tests to determine susceptibility to heating in contact with oxidizing agents have been made on smaller specimens. The results so far obtained indicate that jute presents no greater hazard from this standpoint than other materials which are generally regarded as presenting at the most a low hazard.

Publications.—Research at the Bureau of Standards on Spontaneous Heating and Ignition, by S. H. Ingberg, Safety Engineering, 54, No. 11, p. 256; 1930; and Fire Engineering, p. 357; April, 1930.

Fire Tests of Jute, Technical News Bulletin No. 148, p. 79; August, 1929.

Furnace for Fire Tests of Walls and Partitions.—A new furnace for conducting fire tests of wall and partition constructions was completed. It accommodates specimens 11 feet high and 16 feet wide. Loads up to 350,000 pounds can be applied to the walls during test. The chamber is heated by means of 92 venturi-tube induction type gas burners, the design of which was developed for this furnace. The initial tests will be of light interior partition constructions, such as wood and metal stud partitions faced with different kinds of lath and plaster, wallboard, or other interior finish.

Fire Tests of Roofing Materials.—The data from a series of fire tests comprising all roofing materials in common use were prepared for publication. The tests included ones on new materials, on similar materials from building roofs 5 to 30 years old, and on both new and weathered roofings covered or impregnated with fire-retardant compounds.

Tests of Fire-Detecting Systems.—Tests were made of five automatic fire detecting systems for the Steamboat Inspection Service to determine their acceptability under the law requiring their installation on passenger vessels. These included oven operation and fusion tests of the thermosensitive elements, operation tests on complete installations, and tests to determine effect of vibration, corrosive agents, and mechanical impact.

Other Active Research Projects.—Plans for temporary equipment for fire tests of welded steel floor constructions, to be conducted in cooperation with the American Institute of Steel Construction, were completed. Fire tests were made of columns protected by precast and poured gypsum. Work was continued on the report giving results of compression tests of steel and cast iron at high temperatures. Fire, impact, and loading tests were made of insulated safes to obtain data for revision of Federal specifications. Tests were made to determine the effectiveness of fire-retardant surface treatments for wood scaffolding.

The fire hazard section of Circular No. 75 was rewritten for inclusion in the new revision. Assistance on temperature measurements and related details was given to a committee conducting tests to obtain information on the protection afforded airplane hangars and contents by automatic sprinkler installations. Assistance was given in the formation of an organization of representatives of departments and establishments to be concerned with matters of fire prevention and protection arising in connection with Government activities.

Publications.—Fire Resistance Tests of Building Materials, by S. H. Ingberg, Ice and Refrigeration, 76, No. 6, p. 486; 1929.

Fire Resistant Dwelling Construction, by S. H. Ingberg, J. Am. Ins., p. 23; July, 1929.

Basis of Fire Resistance Requirements in Building Codes, by S. H. Ingberg, Quarterly, Natl. Fire Protect. Assn., 23, No. 2, p. 153; 1929.

GAS ANALYSIS AND SERVICE

Orifice Meter Tests.—The field work during the year on this project consisted of a group of tests made in Los Angeles, Calif., on orifices in 16, 8, and 4 inch lines. Particular attention was given to large diameter ratios and high discharge velocities. The results

of these tests are very consistent, and give further additional information on the effect of the expansion factor upon the discharge co-efficient. The tests with the 8-inch line were particularly good.

There is in progress the review of the results from tests made for the gas measurements committee, natural gas department, American Gas Association, by some of the meter manufacturers. The object of these tests was to obtain information on the effects of such factors as pipe roughness, vane and thermometer well design and location, flange form, orifice edge condition and thickness, and small degrees of eccentricity.

It should be possible to complete both of these reviews within a few months, and to transmit to the gas measurement committee a report covering all of the work done. This would complete the project in so far as it has been planned up to the present time.

Publication.—Determining the Compressibility of a Gas, by H. S. Bean, Oil and Gas J., 28, No. 35, p. 42; 1930.

Gas Analysis.—Several improvements in the details of construction of apparatus for volumetric gas analysis have been developed during the year. These include an improved method of controlling the flow of mercury into the burette, a pipette in which the gas is forced through a perforated platinum plate into the absorbing reagent in the form of very fine bubbles, a compensator with the manometer inclosed to reduce fragility and improved means for cleaning the contact and opening the compensator to air, a new method of lighting the meniscus to permit greater accuracy in reading volumes, and several details of mounting.

Publications.—A Simple Control Stopcock for Gas Analysis Apparatus, by Martin Shepherd, B. S. Jour. Research, 4, No. 1, p. 23; 1930.

A Gas Analysis Pipette for Difficult Absorptions, by Martin Shepherd, B. S. Jour. Research, 4, No. 6, p. 747; 1930.

Specific Gravity Balance.—The development of an improved specific gravity balance for use in connection with the measurement of natural gas was noted last year. This development was completed; the new equipment was given a trial in field use, and has been adopted as the official standard by the Natural Gas Association of America.

Use of Propane in the Lighthouse Service.—A study was made of the practicability of using propane as a fuel for lighthouses. It was found that the kerosene burners now used for the larger lights could be replaced with more simple equipment that would require less attention from the operator, and with the same efficiency in terms of candlepower hours per thousand B. t. u. The greater cost of propane at the present time probably makes its substitution for kerosene inadvisable except possibly for unattended stationary lights.

Domestic Range Burners.—An investigation of the optimum design of domestic gas range burners for using carburetted water gas has been substantially completed. It was the purpose of this investigation to determine the interrelation of the various factors which affect efficiency, safety, and speed, and to find out how these factors differ when using water gas as compared with the use of propane and butane which were previously studied.

Hotel Ranges.—Extensive work was done on the efficiency of the ovens and cooking tops of hotel ranges for gas and a limited amount

of work on domestic electric ranges for the purpose of assisting the purchasing officers of several Government bureaus in the selection of such equipment.

Corrosion of Materials for Gas Oven Linings.—The method of testing the resistance to corrosion of materials for the oven linings of gas ranges has been further developed, and a large number of materials tested. The corroded materials have been submitted to a committee of the American Gas Association, which contributed to the research, as an aid in preparing specifications for such materials.

GLASS AND VITREOUS ENAMELS

Production of Optical Glass.—Thirty-one pots embracing six different kinds of optical glass, borosilicate crown, barium flint, medium flint, dense flint, light barium crown, and ordinary crown were made in attempts to improve melting procedures and to obtain satisfactory quantities of good glass consistently.

Blanks numbering 12,552 and weighing approximately 2,670 pounds, were molded and annealed, the majority being used by the Navy Department.

Increased skill in molding and standardization of shapes and sizes by the Navy Department have resulted in making a greater variety of blanks of moderate size, thus obviating the need for large pieces of glass. Consequently annealing procedures are simplified and a larger percentage of glass is saved.

Viscosity of Glass.—Four hundred and six viscosity determinations have been made on five kinds of optical glass. The most probable values, as shown by graphical analyses of data, are as follows:

| Kind of glass | Viscosity (poises) at— | | | | |
|-------------------------|------------------------|-----------|-----------|-----------|-----------|
| | 1,000° C. | 1,100° C. | 1,200° C. | 1,300° C. | 1,400° C. |
| Barium flint..... | 8, 510 | 1, 514 | 403 | 149 | 74 |
| Light barium crown..... | 6, 840 | 858 | 234 | 94 | 60 |
| Borosilicate crown..... | 3, 390 | 667 | 221 | 120 | 100 |
| Medium flint..... | 2, 140 | 672 | 253 | 110 | 50 |
| Dense flint..... | 2, 100 | 490 | 190 | 93 | 54 |

Physical Properties of Glass as Affected by Thermal Treatment (including annealing).—Tentative values for the changes in refractivity and density of a dense barium crown glass have been added to the list incorporated in last year's report. The approximate increases in refractivity and density for this glass are, respectively, 0.000057 and 0.00044 per ° C. decrease in the effective annealing temperature. This temperature is determined by the character of the annealing, and is essentially that temperature at which the glass is in physicochemical equilibrium; that is, continued annealing at this temperature causes the glass to show no further increase or decrease in either density or refractivity. A report discussing the relationship that exists between these equilibrium conditions, the density changes observed in this investigation, and certain ice-point fluctuations often noted in thermometers has been prepared and will soon be published.

Relations Between Chemical Composition, Density, and Index of Refraction of Glasses.—Data obtained from the index of refraction, density, and composition of 40 glasses of the soda-lime-silica series lead to the conclusion that the index of refraction (N) and density (D) of these glasses can be computed from the following:

$$\begin{aligned} N &= a + b + c \\ D &= a' + b' + c' \\ a &= 0.042712(A)^{0.79487} - 0.2 \\ b &= 0.0153B - 0.00837 \\ c &= 0.017219C - 0.00103 \\ a' &= 0.07977A(86.5 - A)^{0.42107} - 2.203A \\ b' &= 2.0150(B - 0.5)^{1.065} \\ c' &= 0.03415C\left(\frac{A}{B}\right) - 0.04743 \end{aligned}$$

in which A , B , and C are the percentages of silica, soda, and lime in the glass.

The composition of any glass of this series can be determined from its index of refraction and density.

In analyzing these glasses determinations of soda by the zinc-uranyl-acetate method have been found to be satisfactory. Measurements of the thermal dilatation from room temperature to the initial softening point and also of the dispersion of these glasses have been started.

Heterogeneity of Pyrex Glass.—Refractive index measurements on various prisms cut from a pyrex glass disk show that a striated nonoptical glass may be very uniform in its average optical density and indicate that such optical measurements may, in general, be made with high precision and thus be used to supplement or replace mass density determinations which, hitherto, have been used almost exclusively when investigating variations in the properties of commercial glasses. The sheet or ribbon-like striae which are present in such glasses, particularly in those which are made in tanks, have an appreciable effect on the observed refractivities and the proper orientation of the planes of stratification with respect to the light path is an important matter in making such index determinations.

Gases Dissolved in Glass.—More satisfactory methods have been developed for determining the gases in glass which can be removed at high temperature by evacuation. These gases, presumably combined in the glass as carbonates, hydroxides, etc., probably have appreciable effects on the properties of the glass and may be the undetermined cause of serious difficulty in the working of glass sometimes encountered. Several glasses have been made from specially prepared materials to contain only one of the possible dissolved gases and specimens of each prepared for test with and without the removal of the gas by evacuation.

Weathering of Sheet Glass in Storage.—A study of this problem has been undertaken to determine, if possible, the conditions necessary to prevent the fogging or surface deterioration of window glass during storage and the consequent loss to manufacturers of many thousands of dollars annually.

Cast Iron for Enameling Purposes.—Blisters occur in vitreous enameled cast-iron articles, when certain types of iron are used. An investigation to determine causes and remedies for this condition has been completed, and reports describing the work from general, ceramic, and metallurgical points of view, respectively, have been published.

In addition to conclusions previously reported, the following were among those which have since been published: (1) There is ample evidence that mechanical defects, especially "sponginess," will give rise to blisters; (2) a gray enameling iron acquires in cooling a thin surface skin, or "microchill." Removal or decarburization of this skin eliminates blistering, except that caused by physical defects; (3) there are probably two kinds of "nonblistering" iron—one in which a small amount of combined carbon is present in the surface layer; the other in which the cementite is so stable that it takes a relatively long time to break down and form temper carbon, which oxidizes to give the blister-producing gas; (4) a relatively copious evolution of gas (CO_2 and CO) occurs during the first part of the firing, from both blistering and nonblistering irons. It is the rate of evolution subsequent to this initial stage which appears to control the formation of blisters; and (5) in cases where an occasional heat or lot of sound castings shows a tendency to blister, burning out or deep sand blasting appears to be the most practical remedy.

Publication.—Blistering Phenomena in the Enameling of Cast Iron, by A. I. Krynsky and W. N. Harrison, B. S. Jour. Research, 4, No. 6, p. 757, 1930.

Some Physical and Chemical Properties of Certain Vitreous Enamels as Affected by Variations in Composition.—Using analyzed raw materials, two vitreous enamels having identical calculated melted compositions, but differing considerably in their raw batch mixtures, were prepared. The cone deformation temperatures of the two resulting enamels differed by approximately 40°C . To indicate whether this difference might be due to a state of arrested reaction in one or both of the enamels, additional heat treatment was given in platinum crucibles at the temperature of preparation ($1,250^\circ \text{C}$.), and the cone deformation temperatures and indices of refraction determined. The results follow:

| Enamel No. | | Data taken after— | | | |
|------------|---|--|--------------------|--------------------|---------------------|
| | | Initial melting | 4 hours additional | 8 hours additional | 12 hours additional |
| 109----- | Cone deformation temperature ($^\circ \text{C}$)----- | 725 | 730 | 730 | 725 |
| | Index of refraction----- | ¹ 1.514 | | | 1.521 |
| 109-s----- | Cone deformation temperature ($^\circ \text{C}$)----- | 685 | 690 | 690 | 690 |
| | Index of refraction----- | ¹ 1.517 to ² 1.521 | | | 1.523 |

¹ Accurate to ± 0.002 .

² Variable.

The index of refraction tends to increase somewhat in both enamels with additional heat treatment, and no significant variation in cone deformation temperatures occurs throughout the series of

tests. These facts indicate that the initial difference in properties is due to a more stable condition than that of mere arrested reaction.

Publication.—The Influence of Chemical Composition on the Physical Properties of Glazes, by F. P. Hall, J. Am. Ceramic Soc., 13, No. 3, p. 182, 1930.

HEAT AND TEMPERATURE MEASUREMENTS

International Steam Table Conferences.—The first international steam table conference held in London July 8 to 12, 1929, at the invitation of the British Electrical and Allied Industries Research Association was attended by two representatives of the bureau. They also attended the second conference, held in Berlin, June 23 to 27, 1930, at the time of the Second World Power Conference. The first conference adopted a skeleton, or as it might properly be called, a master steam table, with values and tolerances. This table serves as a gage to judge published tables for accuracy. The London conference also defined a new kilocalorie, which is $1/860$ of an international kilowatt-hour, and recommended that this be called the international kilo-calorie. There appears to be little prospect that this proposal will receive unanimous approval, and the National Bureau of Standards has, therefore, suggested the use of the true joule and kilo-joule as heat units, in conformity with existing laboratory practice.

The experimental work done at the National Bureau of Standards was given full recognition in preparing the skeleton table at London. For the Berlin conference, a complete report of the bureau's work on heat content of saturated water and steam up to 270°C. , and on latent heat of vaporization in the range 100° to 270°C. , was available in printed form.

Properties of Steam.—Three papers on this subject have been completed and are to be published in the Journal of Research and in the Transactions of the American Society of Mechanical Engineers. One paper gives a detailed account of the experimental work so far completed. This work yields values of heat content of saturated water from 0° to 270°C. , and of latent heat of vaporization and heat content of saturated steam from 100° to 270°C. Another paper gives the theory of the method employed, while the third is a review and appraisal of other published work on properties of saturated water and steam.

The American Society of Mechanical Engineers, through its committee on physical properties of steam, has recommended and will sponsor and support an extension of the steam research at the bureau. The new program is estimated to require five years for completion, and calls for extending the measurements on saturated water and steam as nearly to the critical temperature as practicable. This will require a new calorimeter as the existing one is designed only for temperatures up to 300°C. The program also includes an investigation of thermal properties of superheated steam over as large a range of temperature and pressure as practicable.

Publications.—Report on Progress in Steam Research at the Bureau of Standards, with Determinations of Heat Content and Latent Heat up to 270°C. , by N. S. Osborne, H. F. Stimson, and E. F. Flock, Mechanical Engineering, 52, No. 2, p. 127; 1930.

The Passing of the Mechanical Equivalent of Heat, by E. F. Mueller, Mechanical Engineering, 52, No. 2, p. 139; 1930.

The Heats of Combustion of Hydrogen, Methane, and Carbon Monoxide.—With a new and improved type of calorimeter, the heats of combustion of the above gases have been measured with a high degree of precision. Preliminary values to which certain small corrections have yet to be applied are as follows:

| International joules per mol 30° C. | Formation of H ₂ O | Combustion of CO | Combustion of CH ₄ |
|---|-------------------------------|------------------|-------------------------------|
| Best value..... | 285,610 | 282,900 | 889,600 |
| Number of good observations..... | 18 | 7 | 5 |
| Average deviation.....per cent.. | — .02 | .03 | .03 |
| Maximum deviation.....per cent.. | — .05 | .07 | .07 |
| Difference from previously accepted values.....per cent.. | — .05 | — .45 | — .75 |

Heat Capacities of Aqueous Solutions.—The problem of properly evaluating the heat capacities of aqueous solutions and the methods of calculating the partial molal heat capacity of solvent and solute have been discussed and applied to aqueous solutions of a number of electrolytes.

Publication.—Heat Capacities in Some Aqueous Solutions, by F. D. Rossini, B. S. Jour. Research, 4, No. 2, p. 313; 1930.

Freezing Point of Platinum.—The freezing point of the platinum of extremely high purity used in the development of the Waidner-Burgess standard of light was determined with an optical pyrometer. The freezing point of pure platinum was found to be 1,773° C. on the International Temperature Scale. It is estimated that the result is not in error by more than 2° C.

Freezing Point of Bismuth.—The freezing point of bismuth of very high purity was determined with a platinum resistance thermometer as 271.3° C. on the International Temperature Scale.

Effect of High Temperatures on Mica.—Nineteen kinds of foreign and domestic mica were heated for half-hour periods at 100° intervals from 600° to 1,200° C. A new sample was used at each temperature, and the eight samples of each kind (one sample not heated) were mounted as a permanent exhibit to show the progressive change with temperature.

Thermoelectric Properties of Metals and Alloys.—The emf against platinum of a series of platinum-rhodium alloys with rhodium content from 1 to 100 per cent was determined last year from 0° to 1,200° C. This year the investigation has been extended to include a series with rhodium from 0.001 to 1 per cent.

The emf against platinum of nickel of very high purity and of spectroscopically pure zinc and cadmium were determined from 0° C. up to the melting points of these metals.

Publication.—Thermoelectric Temperature Scales, by W. F. Roeser, B. S. Jour. Research, 3, No. 3, p. 343; 1929.

Theory of Heat Conduction.—A note on the theory of heat conduction was prepared and published. This paper outlines a method whereby the solution of many problems of steady heat flow with variable conductivity can be obtained directly from the solutions of the same problems with constant conductivity. Many text books state that the solution of problems involving variable conductivity presents almost insuperable mathematical difficulties.

Publication.—Note on the Theory of Heat Conduction, by M. S. Van Dusen, B. S. Jour. Research, 4, No. 6, p. 753; 1930.

Heat Transfer Through Building Walls.—This work, the experimental part of which was completed in previous years, was prepared for publication. The paper contains results on a number of types of walls used for dwelling houses and other small buildings. Tables are included showing the thermal resistances of the various components of completed walls, so that the insulating value of any particular combination can be calculated.

Thermal Conductivity of Insulating Materials at Ordinary Temperatures.—The program of work on the thermal conductivity of fibrous materials was completed during the year, and a paper on the subject presented before the American Institute of Refrigeration. The paper was revised for publication in the *Journal of Research*. The outstanding feature of the work was the demonstration that the arrangement of fibers has a very large effect on the insulating value of a mass of packed fibers.

A popular article on the "Value of House Insulation" was prepared and published in *Good Housekeeping Magazine*.

A mathematical paper, showing the effects of metallic conduction on the heat flow through insulation completely inclosed by sheet metal, was prepared for publication in the *Journal of Research*.

In cooperation with the American Society for Testing Materials, an investigation of the suitability of the use of samples of rubber-graphite compositions as standards for the measurement of the thermal conductivity of electrical insulating materials by a comparative method was completed. The use of this method was found to be satisfactory and accurate enough for the purpose.

In cooperation with a producer, work on the temperature coefficients of conductivity, through the range -30° to $+80^{\circ}$ C., of a number of typical insulating and building materials was completed, and a paper describing the results and the apparatus employed was partially completed.

Radiator Investigation.—The original program of work on cast-iron tubular-type radiators was completed. This work included determinations of effectiveness and heat dissipating ability of the various commercial sizes of radiators of this type. The general conclusion was that the size and style influenced the effectiveness, but not to any great extent. Apparatus was constructed with which to test radiators of the fin convective type.

Testing of Thermometers.—The fees for thermometer testing were substantially equal to the cost of testing, clinical thermometers showing a considerable excess, and laboratory thermometers a deficit. About 94 per cent of approximately 100,000 clinical thermometers submitted were eligible for certification. Tests are now made in conformity with commercial standard CS1-28 except for Government purchases under other specifications. Of thermometers submitted by manufacturers and the public, about 80 per cent were eligible for test. Of thermometers submitted by Government departments, representing purchases under specifications, only 35 per cent were eligible for test.

Gas Thermometry.—A new manometer was developed for the measurement of gas pressures up to 1.5 m of mercury with a precision comparable to that attainable in length measurements. Two glass cells, each 6 cm internal diameter to minimize capillarity, are connected by a flexible, water-jacketed tube. The distance between the

cells is determined by gage blocks. The position of the mercury surface relative to the cell is determined with a precision of about 0.0001 mm mercury by means of a special instrument developed and constructed for this work at the bureau. It employs a radio-frequency oscillating circuit which is very sensitive to small changes in electrical capacitance.

Investigation of Pyrometer Protection Tubes.—The effectiveness of pyrometer protection tubes as a protection against contamination of thermocouples depends to a large extent upon their being impervious to the passage of gases at high temperatures. The rate of passage of air at a series of temperatures up to 1,300° C. was determined for 51 primary tubes of 14 different types and 17 secondary (metal) tubes of 8 different types, representing practically every type of pyrometer tube used in this country.

The investigation showed that, in general, if a tube was gas tight at room temperature, it was practically gas tight up to the maximum temperature at which the tubes were tested.

Low-temperature Cryostat.—An improved cryostat, capable of automatically maintaining temperatures as low as -150° C., constant to better than 0.01° was constructed for use in intercomparing laboratory standards and for use in routine testing.

Special Refractories and Methods for Making Ceramic Shapes for Laboratory Work.—The work which has been done during the past six years in the development of special refractories and special methods for making crucibles for pyrometric and metallurgical research has been prepared for publication. This will make available to other laboratories new developments in technique with which the bureau has solved many special problems in this field.

IDENTIFICATION

Identifications.—During the year the bureau has devoted greatly increased attention to the identification of questioned documents, bullets, and firearms which have been or are to be submitted in evidence in cases in which the United States Government is a party at interest. The testimony of the experts of the bureau who are engaged in this work has in several instances been of vital importance in establishing the guilt or innocence of the defendant, and has been directly responsible for saving the Government very large sums of money.

LEATHER

Acid in Leather.—The investigation of the effects of sulphuric acid on the life and properties of vegetable-tanned leather was continued. Leather tanned with one of the catechol tanning materials was found to possess a high degree of resistance to deterioration by acid, while leather tanned with a pyragallol tanning material showed a low resistance. The influence of the degree of tannage on the deterioration by acid has been studied, and, although leathers which have received a high degree of tannage deteriorate more rapidly, the influence of this factor is not as great as the type of tanning material used and the relative humidity in service. Tests made

regarding the latter show that the rate of deterioration rapidly increases with relative humidities above 80 per cent. A study of the influence of grease content showed that the rate of deterioration was little changed for leathers containing from 10 to 20 per cent of cod oil and tallow. These practical demonstrations of the influence of various factors on the deterioration of leather are destined to be of considerable importance to the maker and user of leather, and will enable more definite quality standards to be established. A ramification of the problem has shown that certain leathers will take up sulphur groups from polluted atmospheres in sufficient quantities to cause deterioration, thus demonstrating the need for means of preserving leather which was originally satisfactorily made.

Fundamental studies are being prosecuted to establish the reasons underlying the deteriorating influence noted, with some expectation that determinations of the combined weights of the different tannins and acids with collagen may yield results of value. A laboratory test to determine the hydrolysis of leathers when digested with acid has been devised, and the results obtained follow very closely the trends shown in the actual aging tests. It is believed that the method offers possibilities in establishing an entirely new method for evaluating leather as to harmful acidity.

Sole Leather.—Determinations have been completed showing the chrome leather which has been retanned with vegetable tanning materials will wear from 25 to 75 per cent longer than ordinary vegetable-tanned leather, depending upon the extent of the retannage. Those heavily retanned so as more nearly to resemble vegetable-tanned leather showed the least increase in comparative wear. The results of these tests are being arranged for publication, and further work has been started to determine whether the added durability of heavily retanned leathers may not be obtained more economically by using curried or flexible vegetable leathers.

Specifications and Properties of Leather.—A study was made of the effect of splitting on the strength of commercial leathers. It was found that the grain portion of the leathers possesses very little strength and that the strength-giving fibers lie in the flesh portion. The failure of many leathers in service is attributed to excessive splitting off of these strength-giving fibers and emphasizes the need of careful attention to splitting on the part of the tanner and shoe manufacturer.

LENS DESIGN

The Algebraic Computation of Spherical Aberration.—The investigation of algebraic methods for computing the aberrations of lenses has been continued. For spherical aberration a new system of formulas has been developed, including terms of the eleventh order together with supplementary formulas for transferring the aberrations from one surface to the next. The formulas have been put into a form suitable for use with a computing machine and have been checked for specific cases by means of parallel computations by the algebraic and trigonometric methods. Whether or not the algebraic method will offer advantages over the trigonometric as regards rapidity of computation depends upon the number of rays to be

traced and the number of orders which it is necessary to retain. However, there are cases in which it is desirable to have a solution with the different orders carried through separately even though additional labor is necessary. It seems probable that if the fifth order term is retained there will be a large number of problems in which it will not be necessary to supplement the algebraic work by a trigonometric solution.

LIME AND GYPSUM

Lime Investigation—(a) SOUNDNESS OF HYDRATED LIME.—Steaming a paste of hydrated lime in an autoclave at 120 pounds pressure has proved most satisfactory to determine the soundness of hydrated lime. The study is being continued on the behavior of hydrated limes of different composition and it is hoped that the method may be made applicable for the testing of the soundness of pulverized quicklime.

(b) PARTICLE SIZE DISTRIBUTION OF HYDRATED LIME.—The particle size distribution of hydrated lime is being studied by determining the rate of sedimentation of lime in anhydrous normal butyl alcohol. An automatic weighing device, capable of weighing to within 0.1 mg, has been set up to follow the course of the sedimentation.

(c) SPECIFICATIONS FOR CHEMICAL LIME.—The recommended specifications for quicklime and hydrated lime for use in soap making were issued as a Bureau of Standards circular. This publication was the thirteenth on which the interdepartmental conference had been working, and completed the series.

Publication.—Recommended Specifications for Quicklime and Hydrated Lime for Use in Soap Making, B. S. Circular No. 372, 1929.

Manufacture of Gypsum Products—(a) PROPERTIES OF GYPSUM FIBER CONCRETE.—The results of the investigation of the compressive strength, modulus of rupture, and modulus of elasticity of gypsum fiber concrete were published in the 1930 annual report of Committee C-11 on Gypsum of the American Society for Testing Materials.

The volumetric changes of gypsum fiber concrete made from five different lots of calcined gypsum are being studied. Specimens of the concrete containing varying amounts of water and wood chips were cast into slabs. Setting expansions ranged from 0.06 to 0.40 per cent. Within the temperature range of 25° to 45° C. the thermal coefficient of expansion of the neat gypsum specimens was about 160×10^{-7} and that of the fiber concrete containing 12.5 per cent wood chips about 130×10^{-7} .

The specimens have been divided into two groups. The specimens of the first group are being alternately wet and dried while those of the second group are alternately stored in moist and in dry air. The volumetric changes of all specimens are being recorded from cycle to cycle.

Studies are also being made to render gypsum products weather-proof.

Properties of Sand-Lime Brick.—A further investigation of the properties of sand-lime brick has been undertaken to determine their weathering ability. Partial immersion as well as total im-

mersion absorption data have been obtained, together with the bulk volume and density of the bricks. At the present time freezing and thawing cycles on these bricks are being made to determine whether a correlation may be obtained between absorptive properties and resistance to freezing and thawing.

LUBRICATION AND LIQUID FUELS

Properties of Petroleum Products.—In cooperation with the American Petroleum Institute, work has continued on the development of apparatus and methods for measuring specific heats, latent heats of vaporization, and heats of reaction during cracking at high temperatures. As a result of measurements of the compressibility and thermal expansion of 14 petroleum oils at pressures 1 to 50 atmospheres and temperatures 0° to 300° C., practical working tables have been prepared whereby the change in volume of an oil with temperature and pressure may be determined readily from a knowledge of specific gravity and viscosity at standard temperatures.

Thickness of Adsorbed Films of Liquids.—Measurements of surface tension of soap solutions have shown that there is no evidence for the existence of thick plastic films on the surface of such solutions, as is sometimes stated. A comprehensive investigation of the viscosity of liquids in very fine capillaries recently completed has shown that there is no rigid adsorbed layer thicker than 0.02 micron on glass or platinum surfaces when covered with liquid, a conclusion of fundamental importance in connection with lubrication.

Gumming Characteristics of Gasoline.—The bureau is making a study of the gumming characteristics of gasolines on behalf of the Army Air Corps. Gum present in gasolines at the time of use may cause objectionable deposits in the intake manifold and on the intake valves. Two problems are involved—gum content at the time of test and gum which forms during storage. In order to develop a suitable test for the amount of gum which is liable to form on storage, it is necessary to make gum content determinations on gasolines at various periods of storage, and this involves the use of a satisfactory method for gum content. The present copper dish method is not satisfactory but, on the basis of intensive work here and in other laboratories, it appears that a suitable method will be available soon. Storage tests and accelerated gum tests will then be undertaken.

Oiliness of Lubricating Oils.—Experiments on the Herschel oiliness machine have confirmed the existence of a finite speed at which there occurs a maximum coefficient of friction. Further studies with this machine have shown an average reduction of 20 per cent in the friction of mineral lubricating oils due to the addition of 2 per cent of fatty acid.

Engine Tests of Lubricating Oils.—In connection with the work on engine tests of lubricating oils being conducted for the Quartermaster Corps, refinements in the methods used for standardizing the tests on lubricating oils were made in the 6-cylinder bus engine adapted for this purpose. Engine operating conditions are automatically recorded throughout the test periods and a systematic method for recording results has been developed. The principal

object of the year's work has been to make check determinations on the two reference oils with which unknown oils are to be compared.

Oil Recommendations.—As it is recognized that viscosity is the most important characteristic determining the suitability of an oil for use in any particular type of engine, a comprehensive statistical study has been made of the various grades of oil recommended by the automotive vehicle manufacturers and oil refiners for about 200 makes of trucks, tractors, and passenger cars. The results have been summarized in convenient form for practical use and published by the Chief Coordinator.

Physical Tests for Grease.—The Bulkley consistometer has been found useful in studying the properties of grease, as described in a recent paper. Tests have also been made with a long metal capillary under high pressures showing that the curve for rate of flow of grease, when plotted against inlet pressure, passes through a maximum due to the consistency of the grease being made stiffer under high pressures.

Publication.—A New Consistometer and its Application to Greases and to Oils at Low Temperatures, by Ronald Bulkley and F. G. Bitner, B. S. Jour. Research, 5, No. 1, p. 83; 1930.

Cutting Fluids.—Scientific analysis of 12,000 returns from 68 of the largest users of cutting fluids showing current machine shop practice, has been completed and reported to the American Society of Mechanical Engineers, as a step in a cooperative program for improving the efficiency of metal cutting operations.

Journal Bearing Performance.—In cooperation with the American Society of Mechanical Engineers tests have been completed on a series of 21 different sets of journal bearings (4 in each set) to determine the effect of the length of the bearing and closeness of fit on friction losses. The results have been reported to the American Society of Mechanical Engineers and represented by curves which should be useful in the practical design of full, cylindrical journal bearings operating under a wide variety of speeds, loads, and oil temperatures.

World Power Conference.—Two papers were presented at the World Power Conference at Berlin, June, 1930, by Dr. H. C. Dickinson, of the bureau's staff: (1) "Scientific Research in the United States on Gasoline Engines" discusses the progress which has recently been made in investigations of the rates of flame travel and molecular transformation in the engine and in experimental bombs, the pressures and temperatures in engine cylinders, and the rates of heat transfer from the metal surfaces of air-cooled engines. Problems connected with supercharging, ignition by spark, bearing and gear lubrication, and valve spring behavior are also mentioned. (2) "Volatile Liquid Fuels" outlines the history of the commercial production, distribution, and utilization of such fuels, describes the characteristics required for automotive use, and discusses specifications for their purchase in large quantities.

MECHANICS

Testing of Engineering Instruments.—The work in the calibration of water-current meters and other engineering instruments has been steadily increasing. The number of such calibrations now exceeds 1,000 per year. A considerable amount of experimental work

was done in cooperation with the United States Geological Survey in the development of new standard suspension arrangements for water current meters.

Automatic Postal Machines.—The bureau has been cooperating with the Post Office Department during the past fiscal year in the technical study and testing of a number of different types of automatic postage vending and postage metering machines for the purpose of determining their suitability, from the standpoint of mechanical design, accuracy, and reliability, for use by the Government.

Numbering Machines.—Additional samples of numbering machines of the lever type have been tested for compliance with the requirements of the performance specification recently developed by the bureau for the Federal Specifications Board. The experimental study of the durability of numbering machines has been extended to develop performance specifications for numbering machines of other types.

Thermostatic Radiator Traps.—The new Government construction program, which will require a great many thermostatic radiator return-line traps, has resulted in activity on the part of manufacturers in submitting traps for type-performance tests. An unusually large number of such tests has been made during the past fiscal year.

Investigation of Propeller Fans.—In cooperation with Paragon Engineers (Inc.), the performance of 2-blade propeller fans has been measured for a wide range of pitch-diameter ratios. The results of the measurements have been published.

Publication.—The Characteristics of Two-Blade Propeller Fans, by H. L. Dryden and P. S. Ballif, B. S. Jour. Research, 5, No. 1, p. 185, 1930.

Fire-Extinguishing Appliances.—The testing and investigation of fire-extinguishing appliances, principally for the Steamboat Inspection Service, to supply technical data upon which the consideration of their approval for use on vessels may be based, has been further extended to include additional devices and new types of equipment. The volume of work of this nature has more than doubled in the past fiscal year.

Elevator Safety Interlocks.—The work undertaken to develop performance tests for elevator interlocking devices has been continued to include the testing of additional commercial devices. The data resulting are made available, as a basis for approval for use in their respective jurisdictions, to certain regulatory bodies, as, for example, the Government departments, certain State governments, and casualty insurance companies. The performance tests developed to insure the reliability and practicability of these devices have recently been adopted, substantially in the form originally developed, as a part of the American Standard Code for Elevators.

METALS

Fundamental Constants and Properties of Pure Metals and Their Alloys.—A publication was issued on the properties of rhodium and the methods for mechanically working it. Additional physical properties of nickel of the highest attainable purity and of thorium have been determined, the results of which will soon be published.

Publication.—Melting, Mechanical Working, and Some Physical Properties of Rhodium, by W. H. Swanger, B. S. Jour. Research, 3, No. 6, p. 1029; 1929.

In cooperation with the alloys-of-iron research committee of Engineering Foundation a critical review of the literature on the preparation and properties of pure iron has been undertaken, the results of this will form the basis of a monograph on the subject and also serve as the preliminary step in further experimental work on the metal itself.

The study of the A_2 (magnetic) change in pure iron by means of the β -ray spectrograph has been continued.

Heat-Resisting Alloys.—Cooperative work has been continued with the joint research committee on the high-temperature properties of metals of the American Society for Testing Materials and American Society of Mechanical Engineers in correlating the results obtained by workers in a number of different laboratories on identical materials. In cooperation with a manufacturer of heat-resisting alloys, work has been continued with the view to coordinating the results of long-time tension tests at high temperatures, the so-called "creep" tests, with similar short-time tests. The results of "creep" tests on a variety of commercial as well as special alloy steels, showing the suitability of the materials for the construction of apparatus for high temperature service were published during the year. The study of the high-temperature properties of the representative alloys of the iron-nickel-chromium series has been continued.

Publication.—Flow Characteristics of Special Fe-Ni-Cr Alloys and Some Steels at Elevated Temperatures, by H. J. French, W. Kahlbaum, and A. A. Peterson, B. S. Jour. Research, 5, No. 1, p. 125; 1930.

Wear-resistant Alloys.—The behavior of identical materials when subjected to "wear" in a variety of ways has been studied with the purpose of establishing reliable laboratory test methods for determining the relative wear resistance of metals. A report is in press. The results emphasize the importance of fitting the testing procedure for wear-resistant materials to the conditions of wear which obtain in service.

Thermal Conductivity of Metals.—Apparatus for determining the thermal conductivity of metal specimens has been designed and constructed. Information on this subject has been repeatedly requested by industry.

Solubility of Gases in Metals.—The equilibrium relations existing between carbon and oxygen in liquid iron at 1,550° to 1,600° C. have been studied, as well as the relation between the carbon and oxygen content of the liquid iron and the composition of an overlying gaseous mixture of CO and CO₂ at a total pressure of 1 atmosphere. The vacuum fusion and the "residue" methods of analyses for determining gases and oxides in steels which have been developed in the bureau's laboratories in recent years have permitted an attack on this problem from several angles, all of which are giving satisfactorily consistent results.

Publication was made during the year on the constitution of the alloys of nitrogen and iron.

Publication.—Observations on the Iron-Nitrogen System, by S. Epstein, H. C. Cross, E. C. Groesbeck, and I. J. Wymore, B. S. Jour. Research, 3, No. 6, p. 1005; 1929.

Corrosion of Metals.—Work has been continued upon the fundamentals underlying the development of reliable corrosion tests. A

publication was issued on the effect of aeration upon accelerated electrolytic corrosion. The study of the effect of the degree of aeration on corrosion of metals submerged in water has been very actively pushed throughout the year. Cooperation with the American Society for Testing Materials in out-of-door exposure tests of metals—zinc-coated iron and steel products, nonferrous sheet materials and screen wire cloth—has been continued. Publication was made, in connection with the last class of materials, correlating failure by corrosion under atmospheric exposure with the contamination of the atmosphere by sulphurous gases.

Publications.—Effect of Oxidizing Conditions on Accelerated Electrolytic Corrosion Tests, by H. S. Rawdon and W. A. Tucker, B. S. Jour. Research, 3, No. 3, p. 375; 1929.

Corrosion Prevention Methods as Applied in Aircraft Construction, by H. S. Rawdon, Preprint of paper presented at meeting of American Society for Testing Materials; June, 1930.

Atmospheric Exposure and Laboratory Tests on Nonferrous Screen Wire Cloth, by G. W. Quick, Preprint of paper presented at meeting of American Society for Testing Materials; June, 1930.

Metal Spraying.—The adherence of sprayed metal coatings as dependent on the preparation of the surface to be coated has received attention. As in previous years, aid has been given the military departments of the Government in several important applications of metal spraying.

Hardness Testing of Metals.—During the past two years, a large number of steel specimens, having high Brinell numbers, have been tested. The results have been used in the derivation of formulas for the relation between the Rockwell and the Brinell numbers. The new formulas do not differ greatly from earlier formulas published by the National Bureau of Standards, but give the metallurgical industry more reliable methods of obtaining the Rockwell number from the Brinell number, or vice versa. The Brinell test is extensively used to control the materials used in engineering. As different observers use somewhat different methods of making this test, a careful study of these variables was made both theoretically and experimentally. Recommendations were prepared covering the load, the time under load, the diameter and mechanical properties of the ball, the apparatus for measuring the indentation, the thickness of the specimen, and the distance of an indentation from the edge of the specimen or from another indentation. If these recommendations are followed, there should be no appreciable differences in the Brinell numbers obtained by different observers.

High-frequency Fatigue Testing.—The air-driven high-frequency machines described in the Standards Yearbook for 1928 have been in constant use in the determination of the fatigue limits of various light alloys. Seven machines of this type are now operating at frequencies of approximately 200 cycles per second. Each test bar is subjected to 200,000,000 cycles of stress if failure does not occur before this limit is reached. The work is being conducted in cooperation with the National Advisory Committee for Aeronautics.

Welded Structures.—In cooperation with the Structural Steel Welding Committee of the American Bureau of Welding, tensile tests have been made of 125 large welded joints, as an aid in determining safe working stresses when designing welded structures.

Electrically Welded Steel Tubing.—An investigation was conducted on the physical properties of tubing made from sheet steel, in which the longitudinal seam was welded under pressure by the electrical-resistance method. Most of the tubes were made from mild steel containing about 0.08 per cent carbon, and a few were made from steel containing about 0.25 per cent carbon. The tubes were subjected to the following tests: (1) Tension, (2) torsion, (3) compression of short specimens, (4) hydrostatic, (5) tension across the weld of circumferential strips, (6) flanging, and (7) hardness around the tube. The tests showed that the properties of the base metal (the metal not affected by the welding operation) can be used in determining the working stresses for different structural uses of tubing made by this process.

Publication.—Physical Properties of Electrically Welded Steel Tubing, by H. L. Whittemore, J. S. Adelson, and E. O. Seaquist, B. S. Jour. Research, 4, No. 4, p. 475; 1930.

Torsional Properties of Tubing.—An investigation of the torsional properties of tubes of different materials, diameters, and wall thicknesses, suitable for use in aircraft, has been undertaken in cooperation with the Bureau of Aeronautics, Navy Department. The first tests are being made on standard sizes of chrome-molybdenum steel tubing up to 2 inches in diameter and up to 0.065 inch thick. These specimens fail by buckling after permanent deformation of the material has begun. The results of this investigation will enable designers to estimate closely the torsional strength of tubular members of aircraft.

Foundry Materials and Methods.—Cooperation with the Steel Castings Research Bureau in the study of steel castings has been continued. Two phases of the work, the first dealing with the problem of low ductility of such castings and the second one relating to "over-reduced" steel, have been completed.

The problem of the so-called "liquid shrinkage" of cast metals has been studied in cooperation with the American Foundrymen's Association, and a report on the first phases of the work has been prepared. The initial stages of the investigation have been devoted to methods of determining the volume changes undergone by metals cooling from the liquid state to room temperature, such changes being considered as definite physical properties of the metal quite apart from variables in foundry practice. Three types of volume changes have been considered, "liquid shrinkage," "solidification shrinkage," and "solid shrinkage." A crucible-immersion method for determining the specific volume temperature curve of a liquid metal was developed, and a sand-cast bar permitting direct readings of length changes in the solid metal was devised. The data from these two methods permit construction of the complete specific volume-temperature curve of the metal from room temperature to a temperature considerably above the melting point of the metal. These tests are being applied in a practical manner to a variety of cast irons.

The test for determining the "fluidity" of metals—that is, the ability of the molten metal to fill completely the mold—has been modified and greatly improved. Very satisfactory results are being obtained.

Toward the close of the year work was undertaken in cooperation with the Non-Ferrous Ingot Metals Institute with the twofold object of showing the unnecessary variety of chemical compositions appearing in present specifications for copper-base casting alloys and also of indicating or developing a type of cast test bar which shall satisfactorily indicate the maximum mechanical properties to be expected from a given alloy. This work has started with a study of the class of alloys represented by the well-known 85 copper-5 zinc-5 tin-5 lead composition.

Efforts have been continued to improve the strength of rubber cements for use as binders for foundry core sand and also to reduce the cost so as to bring them within the reach of the ordinary foundry.

Quenching Media for Steel.—By utilizing the methods developed in the early phases of this work, a study has been made of the characteristics of a number of aqueous solutions for their possible application in a practical commercial way as quenching media in the heat treatment of steels. With one of these, sodium silicate—"water glass"—results have been obtained which indicate its usefulness as a quenching medium with a "cooling velocity" intermediate between water and oil, the commonly used commercial quenching liquids.

Publication.—Hot Aqueous Solutions for the Quenching of Steels, by H. J. French and T. E. Hamill, B. S. Jour. Research, 3, No. 3, p. 399; 1929.

Rail Steel.—Study has been continued of the tensile properties of rail steel at temperatures ranging from normal room temperature to one somewhat below rolling temperature of the rails. A publication has been issued on this subject showing the probable relationship of the low ductility observed at the elevated temperature—"secondary brittleness"—to the development of transverse fissures in the rails later in service.

Further work is in progress on rail steel of various compositions and heat treatment in the endeavor to establish the cause of the phenomenon of "secondary brittleness."

Publication has also been made of the endurance properties of rail steels of special compositions.

Publications.—Effect of Service on the Endurance Properties of Rail Steels, by J. R. Freeman, jr., and H. N. Solakian, B. S. Jour. Research, 3, No. 2, p. 205; 1929.

Tensile Properties of Rail and Some Other Steels at Elevated Temperatures, by J. R. Freeman, jr., and G. W. Quick, B. S. Jour. Research, 4, No. 4, p. 549; 1930.

Endurance Properties of Some Special Rail Steels, by J. R. Freeman, jr. and R. D. France, B. S. Jour. Research, 4, No. 6, p. 851; 1930.

Tensile Properties of Rail and Other Steels at Elevated Temperatures, by J. R. Freeman, jr., and G. W. Quick, American Institute of Mining and Metallurgical Engineers, Technical Publication No. 269; 1930.

High-Speed Tool Steel and the Machinability of Steel.—A report has been issued on the characteristic behavior of tools of high-speed steel containing various addition elements, such as, nickel, cobalt, arsenic, copper, antimony, etc., of which cobalt is the only addition which appears to be beneficial in its effect. A report was also published on the method for studying the behavior of tools when used for finishing cuts. A similar report on the behavior of sintered tungsten carbide lathe cutting tools has been published. In con-

nection with this latter study a number of the characteristic fundamental physical properties of tungsten carbide (sintered into a cobalt matrix) have been determined.

Publication.—Turning with Shallow Cuts at High Speeds, by H. J. French and T. G. Digges, B. S. Jour. Research, 3, No. 6, p. 829; 1929.

Heat-Treated Bridge Wire.—The strength which is necessary in wire to be used in the cables of suspension bridges may be developed by cold working or by heat treatment. Wire of the former class has, however, been used exclusively for this purpose. Attempts to use the heat-treated wire have been unsuccessful. A study of heat-treated wire which had been rejected, undertaken early in the year, is still in progress. Examination of the structural condition, thermomagnetic analysis to determine its condition with respect to heat treatment, endurance, and other mechanical tests have been made. The work will be continued during the coming year, special attention being paid to the effect of surface conditions arising in the zinc coating operation upon the stability of the wire under various conditions of stress.

Prevention of Embrittlement of Sheet Duralumin by Corrosion and of Deterioration of Magnesium Alloys by Corrosion.—The third year of the exposure tests of bare and coated duralumin at the Canal Zone, at Hampton Roads, and at the National Bureau of Standards has just ended. The results closely confirm the laboratory tests concerning the superiority of pure aluminum as a coating material for duralumin and of the necessity of proper heat treatment if maximum corrosion resistance is to be obtained. The tests are to be continued, the initial installation having been based on a 5-year program. Laboratory tests have shown the very decided advantage gained in the coating of aluminum alloys if the surface is given a preliminary treatment by the anodic oxidation process before the application of the coating. The results obtained with the magnesium alloy specimens have shown that the coating of this material to resist atmosphere corrosion is of even greater importance than the coating of aluminum alloys.

Lead Base and Tin Base Bearing Alloys.—In cooperation with the office of the Quartermaster General of the War Department, a study was started early in the year of the comparative merits of lead-base and tin-base bearing alloys. As a supplement to the laboratory tests, bearings representative of the different alloys are being installed in a number of Army trucks and their behavior in service will be closely observed. The work is being continued and is to be extended to include the copper-lead bearing materials.

Bearing Bronzes.—The properties of bearing bronzes for automotive uses as affected by the presence of various impurities—nickel, antimony, and phosphorus—have been studied in cooperation with a large manufacturer of these materials. Antimony appears to be particularly objectionable. Further work is in progress along related lines with special attention to the effect of iron on bearing bronzes.

Fusible Boiler Plugs.—Publication was made of the results of a study carried out in cooperation with the Steamboat Inspection Service on the reliability of fusible tin boiler plugs in service. On the basis of this work, a number of changes were recommended.

One of these, which has received the approval of the Steamboat Inspection Service, is to the effect that the maximum impurities in the tin filling of 0.7 per cent will be allowed instead of the former requirement of 0.3 per cent.

Publication.—Reliability of Fusible Tin Boiler Plugs in Service, by J. R. Freeman, jr., J. A. Scherrer, and J. Rosenberg, B. S. Jour. Research, 4, No. 1, p. 1; 1930.

Platinum Metals.—Research on methods of purification and methods of analysis for the metals of the platinum group was continued. The development of a simple and accurate method for the determination of osmium marked the virtual completion of the first phase of the investigation of analytical methods for these metals; that is, methods of determination. Some work remains to be done on platinum and palladium before the results can be published, but it is now possible to determine each of the six metals with satisfactory accuracy, if they have been separated from each other. Completion of a system of methods of separation, on which some work was done this year and considerable in past years, is the next phase of the research.

Work on methods for the purification of iridium resulted in the development of a method by which metal which is spectrographically pure can be prepared, but which is not satisfactory, either as to speed or yield, for the preparation of reasonably pure iridium in quantity. The very pure metal is needed for other phases of the work on the properties of the platinum metals.

Some modifications were made in the previously developed method for the purification of osmium. The methods of purification are now at about the same stage as the methods of determination, namely, that it is possible to prepare any one of the six metals in any desired degree of purity.

Metals of the Platinum Group.—A study of the properties and mechanical working of the rhodium-platinum alloys is nearly finished. The study of the refractories for use in melting the metals of the platinum group has been completed.

Properties and New Uses for Bismuth.—In cooperation with one of the large producers of this metal, there was undertaken a study of the properties of bismuth and some of its alloys with the object of arousing interest in this little-used metal, which possesses some rather unusual properties, and, if possible, of developing new uses. A circular was issued summarizing information available in the technical literature on the production, physical properties, and the alloys of bismuth. Studies were made of the mechanical working of bismuth by extrusion, of the mechanical properties of bismuth-lead alloys, and of the properties of type metals of the usual compositions and with additions of bismuth. A review of the available information on compositions and melting points of low-melting alloys was undertaken.

Publications.—Bismuth, B. S. Circular No. 382; 1930.

Metallographic Technique.—The report published during the year describing the automatic metallographic polishing machine developed at the bureau has resulted in numerous requests for permission to copy the machine. By utilizing this machine it has been possible to

study the kinds of abrasives and the polishing methods which are suitable and necessary for the various materials the present-day metallographist is called upon to examine.

Publication.—Metallographic Polishing (I) Automatic Metallographic Polishing Machine, by S. Epstein and J. P. Buckley, *B. S. Jour. Research*, 3, No. 5, p. 783; 1929.

Metallurgical Testing and Service for Government Departments.—Only a relatively small number of the metallurgical tests are of a routine nature. Most of these "tests" are distinctly of a research nature, each one requiring a different method of attack. The character of such tests varied greatly as, for example, the restoration of the obliterated identification numbers on stolen firearms, the coating of crystals by metal spraying, the establishing of the cause for service failure of metal structures, as engine crank shafts, rocker arms, etc. Work of this nature was done for 27 different Government bureaus, commissions, and organizations. Very considerable work on the structural permanence of duralumin used as a structural material in aircraft was done. This included participation in the inspection of the U. S. S. *Los Angeles*.

Metallurgical Information.—The dissemination of information to the public, both by letter and directly to visitors, constitutes an important part of the metallurgical work of the bureau. The preparation of circulars summarizing in concise form the information available on the properties of the common industrial metals and their alloys has been continued. The one relating to zinc and cadmium will soon be ready for printing.

Publication.—Current Metallurgical Research at the Bureau of Standards, by H. S. Rawdon, *Metals and Alloys*, 1, No. 4, p. 144; 1929.

METROLOGY

Standard Wave Lengths.—In connection with the suggestion that certain spectral lines characteristic of krypton and xenon might be more suitable as a fundamental unit of length than the wave length of the red radiation from cadmium, the wave lengths of the stronger lines of Kr and of Xe have been compared with neon standards by interferometer methods. The relative values of spectral terms have thus been established with such accuracy that the average deviation of an observed wave number from the calculated value is less than 1 part in 20,000,000. These krypton and xenon lines form the most consistent sets of spectroscopic standards now known in spite of the fact that some of the lines are complex. From certain permitted combinations of terms the wave lengths of infra-red standards can be calculated with high precision.

Publications.—The First Spectrum of Krypton, by W. F. Meggers, T. L. de Bruin, and C. J. Humphreys, *B. S. Jour. Research*, 3, No. 1, p. 129; 1929.

The First Spectrum of Xenon, by W. F. Meggers, T. L. de Bruin, and C. J. Humphreys, *B. S. Jour. Research*, 3, No. 5, p. 731; 1929.

Improvement in Accuracy of End Standards.—Notable improvement in the accuracy of commercial end standards is illustrated by the fact that a set of 11 standards, ranging by steps of millionths of an inch from a nominal length of 0.100000 to 0.100010 inch, were

tested, and all found correct within a maximum error of three ten-millionths of an inch in planeness and parallelism of ends and in length.

Special Material for Line Standards.—The steel under investigation mentioned in the 1930 yearbook proved to be unsatisfactory because of inclusions, flaws, and excessive thermal expansion. A systematic search of stainless steels finally located in a 14 per cent chromium and one-half per cent carbon steel a material which appears to be satisfactory from the five standpoints of polish, homogeneity, hardness, thermal expansion (practically same as platinum), and resistance to corrosion. It appears to have, for the purpose, all the desirable properties of platinum and excels it in hardness, rigidity, and polishing quality.

Comparisons of Length Standards.—In the 1930 yearbook mention was made of an extensive intercomparison of the platinum-iridium meter bars and invar meter No. 39 of the bureau. During the year just closed this work has been continued, special attention being given to the decimeter intervals of the subdivided meter bars and to a group of seven decimeter bars, some of which belong to the bureau and others to cooperating universities. Three decimeter bars belonging to American universities were intercalibrated with four similar bars belonging to the bureau. All seven of these bars were from the same original series issued by the International Bureau of Weights and Measures. While the final results for the various bars are in close agreement, and the determined lengths are believed to be correct to 0.1 micron, they differ, in some cases by as much as 1 micron, from the values as originally certified. A redetermination of the coefficient of expansion of several of these bars, and a determination of their lengths in terms of light waves, are important steps still to be taken.

The work of intercomparing the various platinum-iridium meter bars of the bureau having been completed, the following relations have been determined and will be regarded as official until such time as new certificates may be issued by the International Bureau of Weights and Measures:

$$M\ 27 = 1\ m - 1.40\ \mu + (8.620 + 0.00177\ T) \times 10^{-6}\ T$$

as reported by the International Bureau,

$$M\ 21 - M\ 27 = +5.07\ \mu\ \text{at } 23^\circ\ \text{C.}$$

$$M\ 12 - M\ 27 = +4.49\ \mu\ \text{at } 23^\circ\ \text{C.}$$

$$M\ 4 - M\ 27 = -4.29\ \mu\ \text{at } 23^\circ\ \text{C.}$$

as determined at the National Bureau of Standards. These values represent the actual relations between the various bars within the errors of the most precise comparisons, and it is regarded as very unlikely that the issuance of new certificates by the International Bureau will change any of these values by a significant amount. A redetermination of the coefficient of expansion of the meter bars will be included in the future work on line standards at this bureau.

In connection with the intercomparison of line standards many comparisons of high precision were made on 4-inch scales and

1-decimeter scales. These comparisons have demonstrated that it is practicable to lay off and rule line standards in terms of light waves to a very high degree of uniformity and precision. There is, however, a slight discrepancy, of the order of 0.5 micron, between the absolute length as laid off in terms of light waves and as determined by comparison in terms of the meter. This small discrepancy probably comes from a slight uncertainty as to the phase change on reflection rather than from error in the assumed wave length or in the length of the line standard used in making the comparisons.

Graduation and Calibration of Circles.—During the past year three 9-inch circles for first-order Coast and Geodetic Survey theodolites and six 6½-inch circles for second-order theodolites were graduated. Measurements made at this bureau on the 9-inch circles showed no indications of error in excess of two seconds. Further work in the graduation and calibration of circles is planned for the coming year.

Publication.—Precision Machines and Instruments for the Measurement of Length, by George K. Burgess, World Engineering Congress, Tokyo, Japan, Paper No. 335; November, 1929.

Methods of Length Measurement.—Because of the high precision now being obtained in measurements with the bureau's longitudinal comparator, it seemed advisable to investigate more thoroughly the computational methods used in the determination of the corrections to the subintervals of a graduated line standard.

The method used at this bureau for several years in the intercalibration of two length standards, or two sections of one standard, is that described by Doctor Guillaume, director of the International Bureau of Weights and Measures, sometimes referred to as the Leman-Thiessen method, and currently used at the International Bureau, the National Physical Laboratory, and elsewhere. This method is a great simplification of the rigorous least squares solution.

Certain defects inherent in the abbreviated method have been pointed out by various writers. At least three computational schemes for a complete least squares solution have been published—one by Dziobek, one by Leman, and one by Perard. All of these are very complicated and have hitherto been avoided by most metrologists. One set of observations of the intercalibration of intervals on two decimeter bars is being carried through at this bureau using each of the three rigorous methods and also the simplified method.

The work is not yet complete, but is far enough advanced to permit drawing one or two conclusions. The two German methods (Dziobek and Leman) give final values for the corrections which are found to be identical in this calibration, the maximum variations being 0.0001 micron, this variation being almost certainly due to rounding off the last figure as it had not been considered necessary to carry the results closer than 0.0001 micron, and this only so as to be certain to about 0.01 micron. It should be noted that in outward appearance these two methods are very different, the one by Dziobek which was published first involving less than half as much calculation as the other and being a much more straightforward process. The average variation of the results of Guillaume's simplified computation from these two results is about 0.02 micron. This report can only be considered as a preliminary one.

Standardization of Geodetic Tapes and Wires.—Arrangements have been made for participating in an international series of measurements on invar base-line wires, but these have not yet been received from the International Bureau.

In order to maintain the geodetic tape testing at a high standing, two items deserve consideration. Certain recommended changes in the geodetic tape comparator should be carried out, and consideration should be given to the question of obtaining an interferometer equipment of the type successfully used by the Japanese in measuring long standards, bases, and wires.

Laboratory Work and Testing.—About the usual amount of testing of yard and meter bars, steel tapes, base line tapes, level rods, sieves, haemacytometers, and other standards, instruments, and devices of this character has been carried out during the year. The longitudinal comparator has enabled the bureau to make comparisons and calibrations of length standards not only with high precision, but also with remarkable rapidity. One test during the year demonstrated very clearly that work of this sort done in the past has been accurately done, although with the earlier equipment so much extra time and care were necessary to produce good results that the efficiency was necessarily not as great as at present.

During the past year an unusual number of stage micrometers, micrometer microscopes, and special types of small length comparators were submitted for test.

PAPER

Permanence of Papers.—The testing of representative current commercial writing and printing papers in reference to their probable stability was largely completed during the past year. Some of the results obtained were published in the *Journal of Research*. Progress was made in the preparation of similar types of papers in the bureau's paper mill. These papers will have a definitely known history, and the chemicals and mechanical processes used in their preparation are being varied to measure their effect on paper stability. Expansion of this research to include extensive study of preservation of publications in libraries was made possible through a fund granted by the Carnegie Foundation. With this fund extensive surveys of library storage conditions and a study of their effects on papers are being made. This work includes consideration of the effects of light, heat, and atmospheric pollutions on current papers, and examinations of old papers of known age and history as to these effects. The information so far gained in this research as a whole shows that the degree of purity of papers and their strength are the important factors in their permanence. A permanence classification of printing and writing papers based on these factors was suggested in a paper presented by a member of the staff at a meeting of the American Society of Mechanical Engineers.

Publication.—A Study of Purified Wood Fibers as a Paper Making Material, by R. H. Rasch, *B. S. Jour. Research*, 3, No. 3, p. 469; 1929.

Standardization of Paper.—Laboratory studies were made of several paper products to assist in fixing standards of quality. The results of studies of sheathing papers, made in cooperation with the

National Lumber Manufacturers Association, and of fiber wall boards were published. Similar data for fiber insulating boards were secured. The Gummed Industries Association was assisted in standardization of a test method for adhesion of gummed tape.

Publications.—Paper Standards, by F. T. Carson, Paper Trade J., 89, No. 16, p. 57; 1929.

Paper Research Literature, VII, by C. J. West and B. W. Scribner, Paper Trade J.; May 22, 1930.

A Study of Sheathing Papers, by F. T. Carson and F. V. Worthington, B. S. Jour. Research, 3, No. 1, p. 75; 1929.

Paper-Testing Methods.—A report was published on an extensive study of the bursting-strength test, which included a discussion of the alleged variables in this test, and suggested precautions for minimizing the effect of the more significant variables. An additional publication on the standard type of folding tester was issued, which gives further information on its inspection and calibration. Progress was made in obtaining information on the application of hygrometry to the special conditions of laboratory testing. The cooperative work with the Technical Association of the Pulp and Paper Industry, on the development of official association paper testing methods, resulted in the completion of a method for unimpregnated roofing felt, and revision of the methods for paraffin, starch, and fiber composition.

Manufacture of Paper.—Various studies of paper-making processes and materials were made with the bureau semicommercial paper-making equipment. These included tests to find the coating values of clay and starch products recently developed commercially for this purpose, and study of the paper-making quality of New Zealand flax. All of these materials gave promising results.

Publications.—Historical Sketch of the Bureau of Standards Paper Mill, by B. W. Scribner, Superior Facts (Paper Makers Chemical Corporation, Holyoke, Mass.), 3, No. 2, p. 7; 1929.

Equipment and Research Work of the Bureau of Standards Paper Mill, by M. B. Shaw, Paper Trade J., 89, No. 19, p. 60; 1929.

Paper Activities of the Bureau of Standards, by B. W. Scribner, Paper Trade J., 89, No. 20, p. 57; 1929.

Government Papers.—A publication was issued which gives additional information on the results of experimental study of the manufacture of currency paper. Progress was made in studies of various treatments for protection of the paper money against surface wear, which is now the main limiting factor in its life. In the cooperative investigation with the Bureau of Engraving and Printing on postage stamps, the type of paper used was found to be the most important factor relative to adhesion of stamps. Through experimental studies, a thinner and more flexible paper was developed. Since the adoption of this type of paper, complaints respecting nonadherence of stamps have decreased to a satisfactory minimum.

Publication.—Further Experimental Production of Currency Paper in the Bureau of Standards Paper Mill, by M. B. Shaw and G. W. Bicking, B. S. Jour. Research, 3, No. 6, p. 899; 1929.

Utilization of Cornstalks and Wheat Straw.—The bureau continued to operate the plant at Ames, Iowa, in cooperation with the Iowa State College.

In the manufacture of wallboard from cornstalks, new types of machinery have been tried out in a successful effort to find the equipment best suited for this purpose. With this new type of equipment it has been found possible to make a wallboard one-half inch thick and twice as strong as any insulating board on the market. An insulating board has been made, having a thickness of 2 inches without lamination, which is designed for refrigerators. A detailed report covering the bureau's accomplishments on the manufacture of wallboard from cornstalks is now being printed.

From a process which the bureau has developed a material called maizolith has been produced from cornstalks, which has many characteristics of hard rubber or vulcanized fiber. A report covering the results of this work has been published.

The work on the manufacture of paper from straw pulp is being continued in an effort to improve the quality of the paper produced. Samples of pulp have been forwarded to Washington and made into paper and the paper tested. New quarters have been established and new equipment is being installed for the continuation of this work.

Publication.—Manufacture and Properties of a Cellulose Product (Maizolith) from Cornstalks and Corncobs, B. S. Miscellaneous Publication No. 108; 1930.

PHOTOGRAPHY

Spectral Sensitization of Photographic Materials.—The spectral sensitization produced by bathing photographic plates with mixtures of two important dyes used for this purpose, pinacyanol and pinaflavol, was investigated. Conditions causing coagulation of the dye bath and changes in relative and absolute effectiveness of the two were determined.

Publication.—Spectral Sensitization of Photographic Emulsions. Notes on Bathing with Pinacyanol-Pinaflavol Mixtures, by B. H. Carroll and D. Hubbard, B. S. Jour. Research, 4, No. 5, p. 693; 1930.

Resolving Power and Sensitivity of Motion-Picture Film.—Representative developer formulas of the types recently coming into use for reduction of "graininess" of motion-picture films were investigated for their value in spectrography and other scientific uses demanding the optimum combination of resolving power and sensitivity. It was found that resolving power, as given by the parallel line test object, is not susceptible to any considerable improvement by development methods.

Publication.—A Comparison of Resolving Power and Sensitivity of Photographic Plates with Varying Development, by B. H. Carroll and D. Hubbard, B. S. Jour. Research, 5, No. 1, p. 1; 1930.

New Instrument for Testing Photographic Lenses.—Good progress has been made on the design and construction of a new lens-testing apparatus which, by a series of exposures on a single plate, will give complete information regarding the performance of a photographic lens. The increasing importance of airplane mapping has increased the demand and made improved and more rapid methods for testing necessary at the bureau. Satisfactory mapping can not be done unless the lenses used in the cameras are carefully

selected on the basis of laboratory tests. In recognition of this, the War Department now requires that all bids for airplane mapping projects be accompanied by reports of tests by the National Bureau of Standards upon the individual lenses which the bidders propose to use in their cameras.

PHOTOMETRY

Widner-Burgess Standard of Light.—The experimental work in connection with the setting up of this standard has been completed. The technique and procedure have been refined to a point where the operation is mere routine.

A thorough study has shown that the standard is reproducible, practical, convenient to operate, and inexpensive.

A proposal to have this standard adopted as an international standard is reported elsewhere. The final result obtained is that an opening one square cm in area in a black body at the freezing point of platinum emits light equivalent to 58.84 International candles.

PHYSICAL CONSTANTS

Constant of Gravitation.—This project has been completed and will be given publication in the *Journal of Research* within a short time. The mean result obtained is 6.670×10^{-8} in cgs units.

Absolute Determination of Gravity at Washington.—Preliminary work with brass pendulums has been completed. From the results obtained designs for several pendulums of fused quartz have been prepared. A Shortt clock has been installed for the time measurements necessary.

Ultrasonic Waves.—Experiments have been conducted on the speed of ultrasonic waves in certain liquids. By means of measurements of this character it is possible to determine the adiabatic compressibility of a liquid and of a solid suspended in a liquid in which it does not dissolve.

Elastic Hysteresis Research.—The source of the discrepancy in the values of the elastic hysteresis modulus when obtained by measuring the deflection of bars under load and by observing the damping of tuning forks has been finally located. The results by the two methods agree when in the static method the load is applied to both prongs of the tuning fork and the point of loading is selected in accordance with the results of a theoretical study. This study, which deals with the theory of vibrations of elongated U-shaped bars, is being prepared for publication.

PROTECTIVE COATINGS

Durability of Spar Varnish.—Outdoor exposure starting at two different seasons of the year and laboratory tests and accelerated weathering tests on a large number of commercial varnishes and experimental varnishes made in the laboratory showed that while the durability of spar varnish varies greatly depending on the season exposed, the relative durability of a series of varnishes is quite constant. The accelerated weathering cycle used detected the poor varnishes, but did not differentiate between good and very good varnishes. The kauri reduction test gave fairly good indications as

to durability. Varnishes meeting the tests of Federal specification No. 18b are above the average in durability. Varnishes made from some of the modern synthetic resins were better than varnishes of the same oil content made from rosin, ester gum, or kauri.

Publication.—Durability Tests of Spar Varnish, by C. L. Came, B. S. Jour. Research, 4, No. 2, p. 247; 1930.

Softening Point of Bituminous Materials.—The softening point of materials which, like asphalt, have no definite melting point but which when heated gradually change from brittle or very thick and slow-flowing materials to more mobile liquids, can only be determined by some arbitrary method. A suitable method for this purpose has been developed, based upon a modification of previously used apparatus and procedure.

Publication.—The Ring and Ball Method of Test for Softening Point of Bituminous Materials, Resins, and Similar Substances, by P. H. Walker, B. S. Jour. Research, 4, No. 2, p. 195; 1930.

Accelerated Weathering Tests.—The simple cycle of continuous exposure to light from a carbon arc with periodic spraying with water gives valuable information on pigmented coatings, bitumens, etc. It is, however, too drastic for varnishes and other transparent coatings.

Publication.—Present Status of the Technic of Evaluating Paint Service, by P. H. Walker, American Paint Jour., 13, No. 49, p. 68; 1929; and Paint, Oil, and Chemical Review, 88, No. 13, p. 12; 1929.

Underground Corrosion.—About 3,000 specimens of pipe materials have been removed from 70 locations. Their condition and that of the soil in which they were buried are being determined. This is part of a 12-year project now two-thirds completed.

Field tests of 50 protective coatings in 29 soils have been started with the cooperation of coating manufacturers, the American Gas Association, and the American Petroleum Institute, who will bear about two-thirds of the expense of the investigation.

Seven papers on corrosion and protective coatings have been presented at meetings of technical societies and published in scientific or technical journals.

Publications.—Pipe-Line Currents, by K. H. Logan, Walter Rogers, and J. F. Putnam, Preprint of paper before Tenth Annual Meeting, American Petroleum Institute; December 5, 1929.

Soil-Corrosion Studies, 1927–28, by K. H. Logan, B. S. Jour. Research, 3, No. 2, p. 275; 1929.

Silver Plating.—An investigation of the factors involved in silver plating was undertaken. A study of the methods of analysis of silver-plating baths has been completed.

Conductivity of Chromic Acid Solutions.—There is at present no satisfactory theory of the process of chromium plating. As the first step in the study of the principles involved, the conductivity and density of solutions of chromic acid were determined.

PUBLIC UTILITY RELATIONS

Conference of State Utility Commission Engineers.—The eighth annual conference of State utility commission engineers was held at the bureau on June 5 and 6. Eighteen States and two Provinces of

Canada were represented. Papers were presented on rural electrification standards, submetering, radio interference, high-tension practice, utility appraisal definitions, depreciation and obsolescence, complaints by customers, rate decisions, types of rates, charges for fire protection, distribution extension rules for gas, electricity, and water, urban transportation, future of electric railways, rural telephone service, and questionnaire on gas service.

Government Telephone Service.—The bureau's work on telephone service during the year has been directed almost entirely to Government needs of two kinds. These are, first, the planning of efficient and economical service for Government offices in Washington and elsewhere, and second, the defense of damage suits involving very large claims for telephone equipment used here and abroad during the war period.

The first unit of a group of dial private-branch telephone exchanges planned to serve in a coordinated manner the executive departments and establishments in down-town Washington was put into service May 31. This exchange, consisting of three machine-switching units, one each in the Treasury, Internal Revenue, and Engraving and Printing buildings, together with a manual switchboard, common to all, located in the Treasury Building, consolidates in the most modern way the telephone services of the entire Treasury Department, except the Public Health Service. For the new Commerce Department Building, which will house all of that department's activities except the National Bureau of Standards, a consolidated, combination dial and manual, private-branch exchange has been designed as the most economical method of meeting the telephone service requirements.

In addition to rearrangements of service made necessary by the Government's building program in Washington, detailed studies were carried out for the Budget Bureau on the telephone service for Federal agencies in various other cities. The Supervising Architect is authorized by law to establish and maintain joint telephone service switchboards in Federal buildings under his control where such service is more economical than separate services. Specific recommendations were made as to the telephone services in Asheville, Chicago, Fargo, Kansas City, San Diego, San Francisco, and Springfield.

RADIO

Installation and Maintenance of Primary Frequency Standard.—A primary frequency standard consisting of four special piezo-oscillators of great accuracy was purchased and other essential parts were built by the bureau. Care is taken to maintain this equipment under very constant conditions in order that the frequency may be constant to the high order desired; that is, one part in several millions. Currents are furnished by this standard at 100,000, 10,000, 1,000, 100, and 10 cycles per second, and seconds impulses are given. These accurately known frequencies can be made available for measurement purposes in most of the bureau's buildings. The frequencies of the four piezo-oscillators are found to increase at the rate of about 1 part in 1,000,000 per month.

Improvement of Secondary Frequency Standards.—A study of the reliability of several temperature-controlled piezo-oscillators constructed by the bureau has been carried on. Some of the causes of erratic behavior have been eradicated by improvements in design. Two of the best piezo-oscillators maintain their frequencies from day to day within ± 1 part in 1,000,000. The frequencies of this group of piezo-oscillators have been found to increase about 1 or 2 parts in 1,000,000 per month.

Publication.—Method and Apparatus Used in Testing Piezo Oscillators for Broadcasting Stations, by E. L. Hall, B. S. Jour. Research, 4, No. 1, p. 115; 1930.

Standard Frequency Dissemination.—The bureau continued its regularly scheduled transmissions of eight frequencies per month for the use of university and testing laboratories and other scientific workers interested in accurate frequency calibration. The accuracy of these transmissions is better than 0.01 per cent. Considerable experimental work has been done on a plan to supplement these monthly transmissions by a more continuous schedule on one or more frequencies controlled directly by the primary standard.

Intercomparison of Frequency Standards of Various Laboratories.—The frequency standards of several foreign countries were intercompared by carrying a piezo oscillator to the different laboratories and by measurements on a quartz light resonator circulated by Japan. The latter measurements showed the national standards of four nations to be in agreement within 0.002 per cent.

Publication.—Design of a Portable Temperature-Controlled Piezo Oscillator, by V. E. Heaton and W. H. Brattain, B. S. Jour. Research, 4, No. 3, p. 345; 1930.

Studies of Piezo-electricity.—Studies of the modes of vibration of crystalline quartz plates of various cuts and shapes have been made by observing the patterns formed by lycopodium powder on the surfaces of the plates. The air currents emanating from the periphery of a vibrating circular plate have been utilized to determine the angle of vibration of the plate. The experimental work has been accompanied by a theoretical study of the problem of free vibrations of an elastic solid.

Publication.—New Piezo Oscillations with Quartz Cylinders Cut Along the Optical Axis, by A. Hund and R. B. Wright, B. S. Jour. Research, 4, No. 3, p. 333; 1930.

Radio-frequency Power Factor of Mica.—Power factor measurements between 100 and 1,000 kilocycles per second were made on 34 samples of domestic and foreign mica for the Bureau of Mines for use in a report to the War Department.

Measurement of Radio Field Intensity.—Field-intensity measurements of the past year have shown that the ground absorption of radio signals was much greater than was suspected. Measurements made at frequencies from 550 to 5,400 kilocycles per second over distances up to 3,200 meters over fresh water show that 15 per cent of the signal is absorbed at 1,500 kilocycles and about 50 per cent is absorbed at 5,400 kilocycles. Measurements made of transmissions from broadcasting and Government stations at distances up to 270 kilometers show that the absorption at a distance of 270 kilometers is 99 per cent for a 760-kilocycle transmission and 90 per cent for a 338-kilocycle transmission.

Character and Cause of Variations of Radio Wave Intensity and Direction.—An automatic fading recorder has been in operation, chiefly during the day, for several months at the Kensington field station to provide data on 760 kilocycles for correlation between reception and geophysical phenomena. Magnetic storms have not affected the received intensity but atmospheric have increased. The eclipse of April 28, 1930, did not affect the records.

Improvements in Radio Measurement Methods.—A special metallicallly screened room was constructed in which radio measurements can be carried on without interference from outside sources. A direct-reading frequency device was developed for measurements up to 200 cycles per second. An accurate method was developed for measuring the frequencies of radio stations transmitting on high frequencies.

Measurement of the Height of the Kennelly-Heaviside Layer.—Oscillographic records were made at Kensington on pulse signals sent by NKF on 4,045 and 8,650 kilocycles. The virtual height of the Kennelly-Heaviside layer was from 225 to 250 kilometers on 4,045 kilocycles and about 290 kilometers on 8,650 kilocycles. A 100-kilometer layer was also observed on the lower frequency. The height of the layer changes during the day and is affected by magnetic storms. Measurements have also been made on 1,410 kilocycles.

Radio Receiving Sets for the Coast Guard.—Apparatus was purchased and developed suitable for determining the electrical sensitivity, selectivity, fidelity, and overload characteristics of radio receiving sets. The sets tested included 9 submitted as bid samples to the Coast Guard, 3 high-frequency sets for the Navy, 1 intermediate-frequency set for the Bureau of Lighthouses, 4 aircraft radio sets for the Aeronautic Research Division, and 1 set purchased by this bureau.

RAILROAD TRACK AND OTHER HIGH-CAPACITY SCALES

Calibration of Test Cars at Master-scale Depot.—Fifty-five calibrations were made on track scale test weight cars at the bureau's master-scale depot, at Clearing, Ill. These were made on 25 different cars belonging to 15 different owners, of whom 13 were railroads. Of the 22 major trunk lines entering Chicoga, 5 operate their own master scales. Twelve of the roads furnished calibration service do not own master scales.

The different cars calibrated comprise 17 of the self-contained type and 8 of the compartment type. Ten cars were without air brakes and 13 were equipped with roller bearings, all of these being of the self-contained type.

In 17 of the calibrations, the cars were found to be heavy and in 38 the cars were found to be light. Forty-one calibrations, or 2.4 calibrations per car, were made on self-contained cars; 13 were found to be heavy, and 28 light. Fourteen calibrations, or 1.8 calibrations per car were made on compartment-type cars; 4 were found to be heavy, and 10 light. Exclusive of new cars and of those regarding which there was evidence of repairs previous to receipt for calibration, the average error of self-contained cars was 9.5 pounds and that of compartment-type cars was 58.6 pounds.

Cooperation with Industrial Technical Groups.—The section cooperated with three technical groups, namely, (a) the National Scale Men's Association, (b) the National Scale and Balance Manufacturers Association, and (c) the American Railway Engineering Association, in the development of a code of specifications for railway track scales for light industrial service. As a result of cooperative committee contact with the first group, a code of specifications for the repair and overhauling of large-capacity scales was completed, and a universal test and inspection record form for heavy-capacity scales was also evolved. With the first and third groups a code of specifications for track scale test weight cars was brought to the final stages of completion. That project is now awaiting the consummation of some details with the mechanical division of the American Railway Association.

Formal committee contact which has been maintained for some years with the American Railway Engineering Association on matters relating to railway weighing machinery and methods of use, was continued.

Master-scale Tests.—Of the 19 master-track scales in use in the United States, 16 were calibrated during the year. Several required readjustment or modification. The master scale owned by the Reading Co. at Reading, Pa., was retired and replaced with a new installation early in the year.

Railroad-track Scales.—The total number of railroad-track scale tests conducted during the year was 850, representing an increase of about 15 per cent over the number of tests made during the preceding year, and about 20 per cent over the fiscal year of 1928. Adjustments were made on 57 track scales.

The 3-track scale test units, followed prearranged itineraries, traveled a total distance of more than 19,000 miles, and were operated on 74 separate railroad systems, in 32 States and the District of Columbia. Of the total amount of time on the road, field outfits lost 8.1 per cent on account of repairs and 9.6 per cent from failure in transportation service.

Track Scale Test Results.—An analysis of the data collected during the year shows that 71.8 per cent of the scales tested were weighing correctly within the bureau's tolerance of 0.20 per cent. The average weighing error for the scales tested was 0.21 per cent or slightly more than the above-cited tolerance. The degree of accuracy with which the average railroad track scale now in use will function is believed to be fairly represented by these two values. The figures are substantially the same as those for recent years. As has been pointed out formerly, these figures represent a probable maximum of present attainment. Measures for improvement have been taken but, all things considered, some retrogression in the immediate future may be anticipated. Maintenance of the prevailing high standard from year to year will be considered evidence of a healthy condition.

As indicated by statistics for former years, the scales owned by railroads generally exhibit better weighing performance under test than those owned by industry or commercial organizations. This year, of 523 railroad-owned track scales, 75.7 per cent were correct within tolerance and the average error for all was 0.19 per cent of

the test load value. Of 319 scales owned by industries, 67.4 per cent were correct and the average error for this group was 0.23 per cent. The differences may be ascribed to the fact that the railroads maintain departments equipped and organized to keep their weighing equipment in proper order.

The comparative standing of the eastern, southern, and western districts with regard to the proportion of correct scales is represented by the respective values, 72.3, 64.4, and 79.3 per cent.

Track Scales for Weighing Grain.—A separate analysis made of test results for 41 track scales in grain-weighing service indicates that on the basis of the 0.10 per cent tolerance which is applied to scales in this class of service, 21 scales, or 51.2 per cent of the total, were correct. For the entire group the average weighing error was 0.14 per cent. The bureau's published reports have repeatedly emphasized the fact that comparatively few track scales in grain-weighing service conform to the type specified for this work or are of the kind which will consistently yield correct weighing results. The situation remains unchanged in the main, particularly at grain terminal markets where destination weights are used to fix sales transactions.

In contrast with the grain-handling industries, there may be cited the circumstance that one test unit tested, at a Great Lakes port, 27 scales used for "origin" weighing of carload shipments of coal. With only a few exceptions these were scales of approved specification type. Eighty-five per cent of these were correct within the regular tolerance of 0.20 per cent; 63 per cent would still have been classed as correct had the regular grain-scale tolerance been applied. The average error for all was 0.11 per cent.

Test Car Calibrations in Field.—A part of the work performed in connection with the field testing was the restandardization of the weight of 24 track scale test cars for railroads or industries without master-scale facilities, which for various reasons could not be conveniently calibrated at the master-scale depot. These cars were of various types. Their variations from standard weight values ranged from zero to 108 pounds in deficiency and to 70 pounds in excess, the average variation being 37 pounds.

Track Scale Census.—The railways of the country were circularized to secure a revised census of railroad track scales owned by the carriers and by industries served by them. The returns, now virtually complete, will be used in revising the office records and in working up a new map system as a visible record of locations and test history of scales.

A rather unexpected fact indicated by the returns is that the number of track scales now in use is roughly 25 per cent less than in 1925 when the last census was taken. The reduction in number, although somewhat greater than had been anticipated, may be ascribed to an increasing trend toward elimination of minor weighing points on railroads and to the growing practice of transacting business on the basis of weight agreement rather than on destination or in-transit weights. A close approximation of the number of scales now operating is 3,800 railroad-owned scales and 5,200 industry-owned scales. The figures in 1925 were, respectively, 5,000 and 7,000.

Cooperation with States in Weights and Measures Matters.—In addition to the National Conference on Weights and Measures, held annually at the bureau, the bureau extends its cooperation with officials by means of a considerable correspondence, numerous personal conferences with individual officials, and direct contacts with groups of officials in their own States. Formal State conferences were attended in California, Illinois, Maine, Massachusetts, Michigan, New Jersey, New York, Ohio, and Pennsylvania; informal conferences were held with officials in Connecticut, Delaware, Illinois, Indiana, Minnesota, Nebraska, Nevada, New Hampshire, New Jersey, North Dakota, Oregon, Pennsylvania, Utah, Vermont, Washington, Wisconsin, and Wyoming, travel in these cases being largely incident to attendance at formal meetings.

Preparation of a digest of weights and measures court decisions has been continued during the year; when completed this will be published for the assistance of State and local weights and measures officials in conducting prosecutions and carrying on the strictly legal side of their work.

The issuance of a publication describing equipments in use by officials for the testing of large-capacity scales has resulted in stimulating the interest of officials toward improving their apparatus for this purpose, and numerous new equipments of this character have been put into service or are now being planned.

Publication.—Testing Equipment for Large-Capacity Scales for the Use of Weights and Measures Officials, B. S. Miscellaneous Publication No. 104, 1930.

Cooperation with Other Government Departments.—Frequent consultations have been held with representatives of other Federal departments on weighing or measuring problems and equipment, and numerous weighing and measuring devices have been tested or examined for these agencies, both in Washington and at Clearing. The affairs of the Federal Business Association at Chicago were participated in by attendance at the monthly meetings and otherwise as required on particular details.

Tests of Mine Scales.—The mine scale testing equipment was operated in the eastern coal fields. Tests were made of 185 scales used for weighing coal or clay at the mine. The test results for the separate States and in total appear in the following table:

Mine scale tests

| State | Number of scales tested | Within tolerance | | Not within tolerance | |
|--------------------|-------------------------|------------------|----------|----------------------|----------|
| | | Number | Per cent | Number | Per cent |
| Ohio..... | 77 | 28 | 36.4 | 49 | 63.6 |
| Pennsylvania..... | 25 | 3 | 12.0 | 22 | 88.0 |
| Maryland..... | 29 | 16 | 55.2 | 13 | 44.8 |
| West Virginia..... | 53 | 15 | 28.3 | 38 | 71.7 |
| Illinois..... | 1 | 1 | 100.0 | 0 | 0 |
| Total..... | 185 | 63 | 34.1 | 122 | 65.9 |

The tolerance applied provides for an allowable weighing error of 8 pounds per ton of test load applied,

Regarding mine scales, in general, the experience of the bureau's representatives is that installation practices and operating conditions at mines are not favorable to maintenance of weighing machinery within current tolerances.

Protective Coatings for Heavy Weights.—Research was begun on adequate corrosion protective coatings for industrial test weights of large denomination. This work is expected to continue for at least another year. It contemplates keeping a complete journal control over a great number of weights treated with a variety of recommended protective coatings and subjected to practical conditions of use.

RUBBER

Chemical Nature of Rubber.—Very pure rubber hydrocarbon has been prepared in the gel form. The pure hydrocarbon is clear, colorless, and transparent. By cooling an ethereal solution of this pure rubber, the hydrocarbon is deposited in a crystalline form. Combustion analyses on the pure hydrocarbon have been completed and apparatus is in course of construction for molecular weight determinations and for obtaining photographs of the crystalline rubber.

Abrasion Tests for Rubber.—The study of abrasion tests for rubber has been continued during the past year and as a result, standard test methods have been established. Inasmuch as the abrasive resistance of a rubber compound can not be adequately expressed in absolute terms, it has been necessary to develop a standard compound for comparison and at the same time means for insuring that this standard compound can be reproduced when necessary. In order to check the uniformity of the different lots of standard compound, an abrasive track sufficient for several thousand tests without appreciable change has been installed. By maintaining standard test samples at all times for comparison, it should be possible to include an abrasion test in several of the Federal specifications where such a test is much needed.

A paper describing the abrasion machine and methods of test developed at the bureau, together with data on various types of rubber compounds tested, will soon be published.

Antioxidants in Rubber Compounds.—A very complete series of aging tests has been made on rubber compounds containing various commercial antioxidants. The results show that under practically every condition to which rubber compounds are ordinarily subjected, these materials retard deterioration, although under some of these conditions the effect is much more pronounced than in others. A paper has been prepared for publication describing in detail the various tests made and showing the results obtained.

Effect of Humidity and Temperature on the Properties of Rubber Compounds.—This work, which was conducted in cooperation with the American Chemical Society, has been concluded with the publication of the "Outline of Standard Laboratory Procedure for the Preparation and Physical Testing of Rubber Samples." This outline describes in detail standard methods for preparing and testing rubber samples, and when generally adopted by testing labo-

ratories, will aid materially in bringing about a uniformity of results, which has not existed in the past, due to the lack of a standardized procedure.

Publication.—Outline of Tentative Standard Laboratory Procedure for Preparation and Physical Testing of Rubber Samples. Report of Physical Testing Committee, Rubber Division, American Chemical Society, Rubber Age, p. 429; January 25, 1930.

SAFETY CODES

Safety Codes.—In connection with a committee of national scope a new edition of the elevator safety code has been prepared. Members of the staff have participated actively in the work of the safety code correlating committee and in sectional committees preparing and revising safety codes for various industries. Revisions of the factory lighting code and the code for abrasive wheels were completed by such committees. Work was continued on codes dealing with walkway surfaces; conveyors and conveying machinery; cranes, derricks and hoists; mechanical refrigeration; industrial sanitation; mechanical power transmission; and traffic signs and signals. Assistance was given various States in the preparation of local regulations. A survey of accidents in the homes of club women in North Carolina was made as a preliminary to a movement in cooperation with the General Federation of Women's Clubs, to reduce accidents in the home. Circular 75, "Safety in the Household," has been revised for a new edition.

Publications.—Eyesight is Priceless, by M. G. Lloyd, Safety Education, p. 146; February, 1930.

Safety Code for Brakes and Brake Testing, B. S. Miscellaneous Public No. 107; 1930.

Electrical Codes.—Assistance was given in completing the revision of the Wisconsin State electrical code. Work has been continued upon a pictorial edition of the National Electrical Safety Code. Standard values for the ultimate fiber strength of wood poles were determined upon by a subcommittee and are intended eventually to replace those in the present edition of the code. In cooperation with a national committee, specifications for testing line insulators of more than 750 volts were completed. Cooperation was given a committee of the International Electrotechnical Commission on regulations for overhead transmission lines. Work has been actively going on in preparing standard electrical definitions. Work has been begun upon a new revision of the National Electrical Code of the National Board of Fire Underwriters.

Publications.—The Code, by M. G. Lloyd, Electrical Record, 46, p. 83, 1929.

The Development of the National Electrical Code, by M. G. Lloyd Laboratories Data, 10, No. 11, p. 239; 1929; and The Central Station, 30, No. 1, p. 20; 1930.

The Bare Grounded Neutral and Its Problems, by M. G. Lloyd, Proc. Fifth Annual Meeting, International Assn. of Electrical Inspectors, p. 48; October, 1929.

Neon Signs, by M. G. Lloyd, Proc. First Annual Meeting, Southern Sect., Internat'l Assn. of Electrical Inspectors, p. 113; October 15 and 16, 1929.

Protection Against Lightning.—Miscellaneous Publication No. 95, entitled "Protection of Electrical Circuits and Equipment Against

Lightning," was issued. Assistance was given the National Fire Protection Association in the preparation of a report dealing with oil tanks, and an investigation was carried on in the oil fields of California, Oklahoma, and Kansas.

Publications.—Lightning, by M. G. Lloyd, Bull., Underwriters Laboratories, 10, No. 8, p. 171; 1929.

Protection of Electrical Circuits and Equipment against Lightning, B. S. Miscellaneous Publication No. 95; 1929.

SIMPLIFIED PRACTICE

General Conferences on Simplified Practice.—Fifteen general conferences were held to adopt simplified practice recommendations. This brings the total number of general conferences, held to date, to 127. Simplified practice recommendations covering 113 commodities have been approved and adopted by the affected industries while others are in the process of acceptance. Printed recommendations have been issued for 100 commodities.

Revision and Reaffirmation Conferences.—Thirty-nine conferences of the standing committees of the respective industries took place to consider the desirability of revising existing simplification programs. These meetings resulted in the changing of five recommendations. Thirty-four recommendations, or 85.3 per cent of the total number reviewed, were reaffirmed, without change, for another year. This compares favorably with the figures for the preceding fiscal year, during which 31, or 75.5 per cent, of the 41 recommendations reviewed were reaffirmed. This increase in percentage indicates increasing stability and adequacy of the existing recommendations.

Adherence to Simplified Practice Recommendations.—Surveys of production, distribution and use showed that the average adherence to simplified practice recommendations covering 25 commodities was 86.7 per cent. During the preceding fiscal year, the percentage for 26 commodities averaged 85.43.

Degree of adherence determined by actual survey

| Sim- plified prac- tice rec- ommen- dation No. | Commodity | Degree of ad- herence | Sim- plified prac- tice rec- ommen- dation No. | Commodity | Degree of ad- herence |
|--|--|-----------------------------|--|---|-----------------------------|
| | | <i>Per cent</i> | | | <i>Per cent</i> |
| 1 | Paving brick..... | 87.8 | 49 | Sidewalk, floor, and roof lights.. | 98.2 |
| 2 | Bedsteads, springs, and mat- tresses..... | 91.0 | 55 | Tinware, galvanized and ha- panned ware..... | 90.0 |
| 4 | Asphalt..... | 89.4 | | | |
| 10 | Milk bottles and milk-bottle caps..... | 79.0 | 62 | Metallic cartridges..... | 99.0 |
| 11 | Bed blankets..... | 90.5 | 63 | Metal spools..... | 43.0 |
| | | | 66 | Automobile brake lining..... | 78.9 |
| 12 | Hollow building tile..... | 89.5 | 67 | Roller bearings..... | 58.0 |
| 13 | Structural slate..... | 63.7 | 68 | Metal and fiber flash-light cases.. | 93.0 |
| 14 | Roofing slate..... | 94.5 | 73 | One-piece porcelain insulators... | 91.0 |
| 15 | Blackboard slate..... | 95.6 | 76 | Ash handles..... | 89.0 |
| 24 | Hospital beds..... | 91.3 | 77 | Hickory handles..... | 80.6 |
| | | | 88 | Floor sweeps..... | 96.5 |
| 30 | Roofing ternes..... | 100.0 | 98 | Photographic paper..... | 96.6 |
| 31 | Loaded paper shot shells..... | 99.5 | | | |
| 43 | Paint and varnish brushes..... | 83.7 | | Average..... | 86.7 |

Variety Surveys in Progress.—Upon request the bureau organized 34 preliminary conferences for 32 different industries. In consequence, surveys of existing over diversification of product were instituted by simplified practice committees appointed by 16 of those industries. Similar activity is contemplated by the other 16 groups. There are a number of surveys, started in preceding fiscal periods, which were not concluded this year, but which will terminate during the impending fiscal year. Such surveys provide the bases for specific simplified practice recommendations.

Simplified Practice in the Field of Distribution.—Simplification is not confined to the production end of industry; it is applicable in the solution of problems of distribution. Material-handling equipment and containers in general are subjects that have recently been brought to the bureau's attention. The bureau is now engaged in a field study of wrapping and packing methods and supplies used in department stores. A 10 per cent annual saving in the cost of handling and distributing approximately 3,000,000,000 packages would amount to about \$9,000,000 a year, in the opinion of the industry. Upon request, surveys have been made of 34 department stores, located in 17 cities throughout the United States. The data obtained will be used in the development of specific recommendations.

SPECIFICATIONS

Directory of Governmental Laboratories.—As the result of a request from the War Department, the chief coordinator arranged for the preparation by the National Bureau of Standards of a classified list of all governmental laboratories, facilities, etc., available for the testing of supplies and materials for the purchasing officials of the various governments. In this directory information is given concerning not only the kinds of commodities which each laboratory can test, but also the types of testing equipment in each laboratory, and the routine procedure involved in obtaining authority for the laboratory to assist purchasing officers in making tests and furnishing results relating thereto.

Encyclopedia of Specifications.—Manuscript for the second volume of the encyclopedia series, entitled "Standards and Specifications for Nonmetallic Minerals and their Products," the publication of which was delayed for lack of funds, was revised to bring it down to date and it has been printed for distribution as Miscellaneous Publication No. 110. This is a companion volume to "Standards and Specifications in the Wood-Using Industries," already published, and "Standards and Specifications for Metals and Metal Products," the manuscript of which is now under preparation.

Cooperation with Public Purchasers.—The bureau is compiling both the Encyclopedia and the Directory of Commodity Specifications in compliance with the many requests from State, county, and municipal agencies making purchases out of tax moneys, for aid in solving some of their purchasing problems. In connection with these undertakings and the compilation of material for the Standards Yearbook, it has established contacts with more than 25,000 public purchasers.

SPECTROSCOPY AND ATOMIC STRUCTURE

Spectrochemical Analysis.—Besides numerous tests of metals, alloys, precipitates, etc., for the identification of chemical elements and the detection of impurities by spectroscopic methods, researches on the structures of certain spectra have given information as to the lines which may be expected to be most sensitive for this purpose. In particular, new descriptions of the spectra characteristic of lutecium have made an analysis of their structures possible. This is the first of the 14 rare-earth elements to succumb to this method of analysis which gives information concerning atomic structure and the relative value of different lines for spectro chemical identification.

Publications.—The Arc Spectrum of Arsenic, by W. F. Meggers and T. L. deBruin, B. S. Jour. Research, 3, No. 5, p. 765; 1929.

Regularities in the Arc Spectrum of Hafnium (Hfr), by W. F. Meggers and B. F. Scribner, B. S. Jour. Research, 4, No. 1, p. 169; 1930.

Regularities in the Spectra of Lutecium, by W. F. Meggers and B. F. Scribner, B. S. Jour. Research, 5, No. 1, p. 73; 1930.

The Arc Spectrum of Bromine and Its Structure, by C. C. Kiess and T. L. deBruin, B. S. Jour. Research, 4, No. 5, p. 667; 1930.

Equipment for Measuring the High Direct-Current Potentials of X-ray Generators.—Up to the present the spark gap has been used almost exclusively for this purpose, with inadequate accuracy. An equipment of the voltmeter-multiplier type with an error of only two-hundredths of 1 per cent has been devised, constructed and found entirely satisfactory for measuring the rippled voltage furnished by several types of X-ray generators.

Atomic Structure Investigations.—Studies of the photoelectric effect in metal vapors, particularly caesium vapor, have shown that the sensitivity extends far beyond the range predicted by theory. The mechanism of this anomolous sensitivity is found to involve a photochemical reaction between the atoms which are excited by absorption of light and other atoms, and the constants of these reactions have been studied. A unique feature of the study is that the series of atomic absorption lines gives a series of chemically different excited atoms. Addition of foreign gases modifies the reactions in a manner characteristic of the excited atom and the added gas.

Publication.—The Neutralization of Space Charge by Positive Ions in Cæsium Vapor, by V. E. Whitman, B. S. Jour. Research, 4, No. 1, p. 157; 1930.

Cosmic Radiation.—As a result of experiments using three Geiger Mueller tube counters placed vertically one above the other, it has been found that a strong magnetic field introduced between the two lower counters causes a decrease in the number of coincident responses of the three counters.

The coincidences are presumably due to cosmic radiation; hence, since only moving electrified particles would be deflected by a magnetic field, these experiments are interpreted as indicating that the cosmic radiation consists of electrified particles with velocities corresponding to 10^9 volts accelerating potential.

Radium Testing.—One thousand one hundred and seventy-three preparations of radium, totalling nearly 10,000 milligrams of the element, and fixing a sale value of about \$650,000 were tested; also, 67 samples of luminous materials were measured for brightness.

STONE

Elastic Pointing Materials.—The increased use of elastic pointing materials has caused a larger demand for tests on such products. A special apparatus has been designed and built in the bureau's instrument shop for the purpose of determining the effectiveness of these materials in masonry joints when subjected to tensile stresses. This equipment has materially simplified the testing process and overcomes the difficulties experienced in the former process which utilized a built-up section of masonry.

Slate.—A study of the weathering of roofing slate was undertaken during the year with the purpose of developing a more satisfactory specification for this material. Samples were secured from old buildings where various slates had been exposed under service conditions for periods ranging from 12 up to more than 100 years. This has afforded considerable information of value in regard to the nature and causes of slate weathering. It has indicated that some deposits of slate in this country are very resistant to the destructive weathering agents while others may not be good for more than 25 years of service. Considerable progress has been made by way of differentiating by laboratory means between good and poor weathering slates.

SUGAR

Hard Refined Levulose Production.—The bureau's researches in connection with the problem of determining whether the finest of all the sugars, levulose, can be produced on a commercial scale under present economic conditions, has been continued with satisfactory results. Any development of this character involves the designing and building of new and complicated equipment. Portions of this plant were placed in actual operation, and studies made of the functioning of various steps in the process, especially the conversion of the artichoke juice, and the formation of the levulose calcium compound which is essential, with present available liquor purities, for the purification of the crystalline levulose. Among the more important pieces of plant equipment which were perfected may be mentioned the crystallizer with temperature control, the granulator for the continuous drying of the crystalline product, and an automatic feeding mechanism for the reactors. Constant improvement has been made in a system of analyses of levulose products, this being essential for the chemical control of the plant. In this work the densities, rotatory powers, and refractive indices of pure levulose solution have been determined. From the products of the hydrolysis which is necessary for the conversion of the plant polysaccharides to the sugar, two new crystalline difructose anhydrides have been discovered. In addition, approximately 50 tons of artichokes were extracted and the juice concentrated to furnish a continuous supply of material for factory experimentation.

Standardization of Sugar Products.—The problem of suitable specifications and standards for commercial sugars has long been one of the outstanding problems in the sugar industry. Satisfactory progress was made in the comprehensive study which the

bureau has undertaken. Numerous representative samples of white granulated sucrose were carefully studied by means of spectrophotometric analysis and existing knowledge of the small but all-important amount of color remaining in these so-called white products was materially extended thereby. It is expected that these data will be of assistance in the classification of commercial sugars according to color. An important by-product of this work was the simplification and improvement of some methods used in sugar colorimetry.

Crystallographic Studies of the Sugars.—The identification of crystals and the determination of their crystallographic properties has become an indispensable aid to the advancement of knowledge in the carbohydrate field. It involves the use of various optical devices, including the petrographic microscope and instruments for the measurement of crystal angles. A considerable expansion was made in the bureau's facilities for this work, including microphotographic work and the actual growing of perfect crystals under controlled conditions. Among the more important accomplishments may be mentioned a comprehensive study of crystalline turanose, a little-understood rare sugar.

The Structure of the Sugars.—During the year a very considerable expansion was noted in the number of scientific investigators working on problems intended either to increase our knowledge of the molecular structure of the sugars or to discover new sugars and sugar derivatives. The demand for new facts of this character necessitated a considerable increase in the bureau's activities in these fields. A number of new compounds and methods were found, among which were (1) a method for separating methyl glycosides which yielded two crystalline methyl glucosides, and (2) a method for deacetylation by means of a small quantity of barium methylate which gave monoacetyl-glucosido-mannose, a representative of a new type of sugar derivatives. The general problem of a possible relation between optical rotation and atomic dimension was attacked and for the first time new substances were prepared for testing this relationship. What is known as the fluorating process for sugars was studied, and four new crystalline compounds of levulose were prepared in the course of the investigation.

Publications.—Two Isomeric Crystalline Compounds of *d*-Mannose with Calcium Chloride, by J. K. Dale, B. S. Jour. Research, **3**, No. 3, p. 459; 1929.

A Crystalline Difructose Anhydride from Hydrolyzed Inulin, by R. F. Jackson and S. M. Georgen, B. S. Jour. Research, **3**, No. 1, p. 27; 1929.

The Structure of Alpha Methylxyloside, by F. P. Phelps and C. B. Purves, B. S. Jour. Research, **3**, No. 2, p. 247; 1929.

Optical Rotation and Ring Structure in the Sugar Group. The Optical Rotation of the Various Asymmetric Carbon Atoms in the Hexose and Pentose Sugars, by H. S. Isbell, B. S. Jour. Research, **3**, No. 6, p. 1041; 1929.

Relations Between Rotatory Power and Structure in the Sugar Group. Part 20, Two Isometric Crystalline Compounds of *d*-Mannose with Calcium Chloride, by J. K. Dale, J. Am. Chem. Soc., **51**, p. 2788; 1929.

Relations Between Rotatory Power and Structure in the Sugar Group. Part 21, Beta-Thiophenol Glycosides of Glucose, Xylose, and Cellobiose, by C. B. Purves, J. Am. Chem. Soc., **51**, p. 3619; 1929.

Relations Between Rotatory Power and Structure in the Sugar Group. Part 22, Evidence Concerning the Ringed Structure of Beta-Thiophenol Cellobioside and Beta-Thiophenol Lactoside, by C. B. Purves, J. Am. Chem. Soc., **51**, p. 3627; 1929.

Relations Between Rotatory Power and Structure in the Sugar Group. Part 23, The Preparation and the Structure of Beta-Thiophenol Maltoside and its Hepta-Acetate, by C. B. Purves, J. Am. Chem. Soc., **51**, p. 3631; 1929.

Manufacture of Xylose.—In cooperation with the University of Alabama, the Alabama Polytechnic Institute, and the Alabama industrial development board, the bureau successfully operated a semicommercial factory at the plant of the Federal Phosphorus Co., Anniston, Ala., for the manufacture of xylose from cottonseed hull bran, and other raw materials such as peanut shells and corncobs.

By a process developed in the laboratory in Washington, xylose was manufactured at the rate of 100 pounds per day. The crude xylose was given a purification and recrystallization treatment which rendered it 99.99 per cent pure.

In an effort to develop markets for xylose samples have been forwarded to individuals and concerns all over the world who are co-operating in the investigation of its possible use in the dyeing and tanning industries, in foodstuffs, in explosives, for manufacture of chemicals, of alcohol to be used as solvent for lacquer, etc.

The bureau has completed its work on xylose from the manufacturing point of view and a report in detail covering the results is being published.

Laboratory work is being continued in converting xylose to sugar acids, and in devising analytical methods for xylans, lignins, cellulose, etc.

Publication.—Preliminary Investigations Upon Two Cellulosic Wastes as Sources for Xylose, by W. L. Hall, C. S. Slater, and S. F. Acree, B. S. Jour. Research, 4, No. 3, p. 329; 1930.

TEXTILES, DYES, CLEANING, ETC.

Silk Weighting.—In cooperation with a group of 12 national associations, including the Silk Association of America, National Retail Dry Goods Association, National Better Business Bureau, and the American Home Economics Association, technical studies have been made on the effect of tin weighting on the properties of silk. Contrary to the belief at the time the work was started, it was found that not only the amount of weighting, but also the method of applying it, the construction of the fabric on which the weighting is applied, and other factors have an important influence on the serviceability of the silk. A study was made of the deterioration of silks weighted to different extents when exposed in the diffused light of a room. A standard method for determining the amount of weighting on silk was developed. Work was started on the development of an accelerated aging test from which the serviceability of silks may be predicted.

Cotton Fabric for Parachutes.—In cooperation with the National Advisory Committee for Aeronautics, the study of cotton fabric for parachutes was continued. Improvements were made in this fabric, particularly in the direction of increasing the resistance to tear. At the present time, at least two commercial firms are producing fabric suitable for parachutes.

Coarse Fabrics (Bagging, etc.).—In order to find out what construction of yarn and of fabric would best answer the requirements of specific uses in the coarse-fabric field, such as for rice bags, baling, coarse draperies, etc., a systematic study of the relationship between the properties and the twist, yarn number, and construction was

made. Three hundred and twenty fabrics were produced in the cotton mill of the bureau in the course of this investigation.

White Stainless Mineral Oil Lubricant for Textile Knitting Machines.—The study of mineral oil lubricants for knitting machines has resulted in a tentative specification for a truly stainless mineral oil lubricant. Practical tests of this oil in three large hosiery mills over a period of six months indicates that this lubricant should go far toward the elimination of oil stains on hosiery, which in the past have resulted in serious losses to the industry.

Substitutes for Chromium in Dyes and Dyeing.—At the request of the War Department, Quartermaster Corps, a study was made of the uses of chromium in the manufacture and application of dyes and substitutes for or a means of eliminating chromium from these uses were suggested. This work was undertaken in order to make possible the release of this material for military purposes in time of war.

Textile Test Methods.—The utility of fabrics for certain purposes depends to a large degree on such special characteristics as smoothness of surface, stiffness, resiliency, and thermal transmission. A simple method has been devised for specifying the slipperiness or smoothness of a fabric by measurement of the coefficient of friction between two pieces of the material. A "Flexometer" for measuring the energy required to fold the fabric and the energy which is recovered when the sample is allowed to unfold has been built. The energy required to fold the sample is a measure of its stiffness and the recoverable energy expressed as a percentage of the energy input is a measure of its resilience. The energy which is lost when a sample is folded is dissipated in producing a crease in the fabric and may, therefore, be taken as a measure of the wrinkleability of the fabric. Stiffness, resilience, and weight all contribute to the ability of a fabric to drape well and it is believed that the Flexometer can be applied to the evaluation of drape. An apparatus for rapidly measuring the thermal transmission of fabrics was built during the year.

Publications.—New Rayon Testing Methods Described, by W. D. Appel, Daily News Record, Rayon Section, Sec. 3, p. 28; September 16, 1929.

Research on Textiles, by H. D. Hubbard, Am. Dyestuff Reporter, 18, No. 7, p. 662; 1929.

Rayon Investigations at the Bureau of Standards, by W. D. Appel, Textile World, 76, p. 4372; 1929.

Fastness of Dyed Fabrics to Dry Cleaning, by A. S. Eichlin, B. S. Jour. Research, 3, No. 1, p. 39; 1929.

A Method of Measuring the Stress-Strain Relations of Wet Textiles with Application to Wet Rayons, by H. A. Hamm and R. E. Stevens, B. S. Jour. Research, 3, No. 6, p. 927; 1929.

THERAPEUTIC ACCESSORIES

Effect of Ultra-violet Rays on the Transparency of Special Window Glasses.—Exposure to the mercury arc diminishes the ultra-violet transmission of these glasses more than exposure to the sun. During the past year, it has been found that exposure of these glasses to the sun, after their exposure to the mercury arc, raises their ultra-violet transmission above the minimum value obtained with pro-

longed exposure to the sun. In 17 out of 20 samples, comprising 6 different makes of special window glasses, the recovery was from 1 to 6 per cent above the minimum value obtained by exposure to the sun alone. This recovery appears to be produced by radiation of wave lengths in the region of 365 millimicrons.

Publications.—Recent Developments of Window Materials and Fabrics for Transmitting Ultra-Violet Radiation, by W. W. Coblenz, Trans., Illum. Eng. Soc. 25, No. 4, p. 359; 1930.

Data on Ultra-Violet Solar Radiation and the Solarization of Window Materials, by W. W. Coblenz and R. Stair, B. S. Jour. Research, 3, No. 5, p. 629; 1929.

Study of X-ray Generators.—Through the cooperation of a number of manufacturers of X-ray equipment, an investigation of the characteristics of the various types is under way. This service has been extended to equipment located in hospitals.

Development of X-ray Standards.—Methods have been devised and apparatus constructed for the precise calibration of X-ray dosage meters. This service has been established and a number of instruments have been calibrated for cancer hospitals.

A portable secondary standard X-ray ionization equipment of weight and volume about one-fifteenth that of the standard equipment has been developed for comparing directly the standards in this country and abroad—a condition heretofore impossible of attainment with sufficient accuracy.

Publications.—The Precise Measurement of X-Ray Dosage, by L. S. Taylor, Radiology, 14, p. 372; 1930.

Analysis of Diaphragm System for the X-Ray Standard Ionization Chamber, by L. S. Taylor, B. S. Jour. Research, 3, No. 5, p. 807; 1929.

THERMAL EXPANSION

Thermal Expansion of Solids.—(a) **THERMAL EXPANSION OF NICKEL-CHROMIUM-IRON ALLOYS.**—An investigation on the thermal expansion of various nickel-chromium-iron alloys was started in September, 1929. There have been many applications of various combinations of nickel, chromium, and iron for both heat and rust-resisting properties. Most of the alloys investigated have been found resistant to heat up to 1,000° C. The investigation is still in progress.

(b) **THERMAL EXPANSION OF CARBOLOY.**—Data on the thermal expansion of carboloy, a tungsten carbide containing cobalt, have been obtained at various temperatures between 20° and 400° C. It is planned to obtain additional data on samples of carboloy containing various percentages of cobalt in order to determine the effect of cobalt.

Publication.—Thermal Expansion of Carboloy, by Peter Hidnert, Phys. Rev., 35, p. 120; 1930.

Thermal Expansion Apparatus.—During the year there was a very marked increase in the demand for details of the fused quartz expansion apparatus designed by the bureau for use in commercial laboratories. Information and blue prints have been supplied to individuals and companies upon request. Reports from firms installing this equipment show decided satisfaction from its use.

These installations appear to have reduced materially the number of fee tests requested of this bureau, and consequently have given more time for research problems.

Precision Screw Cutting and Ruling.—Work on the bureau's precision ruling machine has been taken up again after a lapse of 18 months following the death of the expert machanic who for several years had devoted his entire attention to the problem. Good progress has been made and it is expected that the machine will be completed and in successful operation within the next few months.

TIME

Seconds Signals from a Pendulum by Use of a Photo-electric Cell.—Seconds signals from the pendulum of the bureau's Rieffer clock, by the use of a photo-electric cell, as mentioned in the 1930 yearbook, have been in successful use during the year in three of the bureau's laboratories requiring seconds signals of high uniformity and accuracy. A new precision clock designed by the chief of the time section, and especially adapted to use with the photo-electric cell, is now being constructed.

Cooperation with Horological Institute of America.—The bureau has continued to cooperate with the Horological Institute through the testing of repaired watches submitted to the institute by individuals as a part of its examination to determine fitness for certification as qualified watch repairmen. During the year certificates have been granted to 85 junior watchmakers and 40 certified watchmakers.

Specifications for Stop Watches.—The bureau has assisted the technical committee of the Federal Specifications Board in preparing purchase specifications for various types of stop watches. These specifications have been submitted to manufacturers and users for criticism, and are now in final form for approval by the board.

WEIGHTS AND MEASURES

Lacquer for Weights.—Eighteen samples of insulating lacquers or varnishes were investigated as to their change in weight with ordinary changes in the humidity of the air. None of these was radically different from those previously investigated.

Some lacquered weights known to be about 23 years old and lacquered with shellac lacquer were investigated to determine whether they had become more constant with age. Results indicated that age has no tendency to change its behavior.

To determine how much of the variation of ordinary screw knob weights resulting from changes in humidity is actually caused by the lacquer, it is planned to determine the total variation on bare weights having a cavity and screw threads under the knob. It is hoped that the work on these samples can be completed early next year.

Improvement in Constancy of Weights.—The investigation on variability of weights with changes in the humidity of the air has benefited the users of ordinary laboratory weights mainly in two

ways. In the first place, the percentage of variable weights on the market has been radically reduced. Of the sets submitted to this bureau for test, the percentage rejected from this cause has dropped from 30 in 1928 to 11 in 1930. In the second place, the introduction of a determination of this variability, as a regular part of this bureau's test for certain classes of weights, has definitely prevented many laboratories from receiving seriously variable weights that would otherwise have been sold to them.

Maintenance of Standard Weights.—During the past year about 200 of the standard weights of the mass section were recalibrated. This is nearly five times as many as were recalibrated during the preceding year, but is probably no more and perhaps is less than should be calibrated each year. These standards vary in accuracy and in importance from the equivalent of ordinary analytical weights up to the three primary pound standards of this country.

Equipment for Testing Weights.—The new high precision, 200 g balance has been found to have a precision of 0.01 mg in weighing loads of 200 g, or 1 part in 20,000,000. The balance proved satisfactory, being particularly reliable for loads well below its capacity. This balance constitutes a valuable addition to the equipment of the section. Another high-grade new balance tested and put into use during the year is one of 50-pound capacity, also ordered near the close of last year. This has also filled an urgent need.

Testing of Weights.—There were 8,216 weights received for test during the past year. This is the largest number ever received during this length of time, and is about 20 per cent more than were received last year. Chiefly because of the necessity for doing more work on the standards of the bureau, the number tested and sent out was about 5 per cent less than last year, the total being 7,683. Last year the number of weights awaiting test was much reduced during the year, but this year the number on hand has risen again to about 1,000.

Chromium Plating, Platinum Plating, and Nichrome for Weights.—Chromium plating is being given a service test on three sets of analytical weights that are being used in laboratories of the chemistry division of this bureau. Since these have not been radically better or worse than other electroplated weights of the same type, it is indicated that the advantage of hardness may be more than compensated by other sources of change, although the danger of attack by hydrochloric acid fumes seems somewhat less than was feared.

Thirteen old sets of analytical weights that were platinum plated a year or two ago have not been found to be very constant. About 30 per cent of the weights gained approximately 0.1 mg in spite of such wear as may have been caused by use. The largest changes were shown by two 100 g weights, which gained 0.4 and 0.8 mg, respectively.

In order to obtain data on the usefulness of nichrome for weights of different grades, preliminary plans were made for investigating this material.

Density of Aquaammonia.—An investigation of the density and thermal expansion of anhydrous ammonia and of various percent-

ages of aquaammonia has been requested by a large producer of these products, on account of their greatly increased industrial importance and the lack of adequate and reliable information. The necessary material and apparatus for this investigation have been obtained and the work will be undertaken in the near future.

Density of Chromic Acid Solutions.—Density determinations were made on several samples of chromic acid, and the results obtained have been incorporated in a paper prepared by a member of the chemistry division.

Glass Volumetric Apparatus and Hydrometers.—During the year, 14,544 pieces of glass volumetric apparatus and 1,104 hydrometers were submitted for test. This represents a slight decrease from the previous year, but the change is so small as to be insignificant. The quality of the apparatus has remained high, 98 per cent of that submitted having been found qualified for test, and 94 per cent of that tested having passed the test for accuracy of graduation.

Certification of Master Gages.—The measurement and certification of the accuracy of the dimensions of master gages has constituted a large part of the work of the gage section during the past year, and, as in other recent years, the master gages of the American Petroleum Institute have constituted an important item. With the exception of one size of rotary tool joint gages, the dimensions of which have not been finally decided upon, the work of measuring the grand and regional masters of A. P. I. rotary tool joint gages has been completed.

A large number of A. P. I. sucker-rod gages were measured and approved during the year, so that now the principal manufacturers of sucker rods are supplied with approved gages. Because of the difficulties encountered by gage makers in meeting the specifications in regard to angle of cone it was found necessary to increase the tolerance so that a reasonable percentage of the gages submitted might be approved. The increased tolerances are not inconsistent with approved gaging practice.

Master gages must be remeasured at periodic intervals to detect wear, or other dimensional changes, and a number of A. P. I. master gages were submitted for recheck during the year. It is expected that they will be submitted for recheck in greater numbers during the coming year. The work of rechecking the regional and grand master cable drilling tool joint gages was begun in June and the results so far obtained indicate that some of these gages, as a result of wear, are no longer within tolerance.

In addition to the A. P. I. master gages tested, about the usual number of master gages were submitted by the manufacturers of other products, particularly automobiles and accessories. A 70 per cent increase over the preceeding year in the number of precision gage blocks, and a decided increase in the number of polariscope tubes submitted, were noted. Several large diameter thread worms were tested, some of which were to be used in burnishing the teeth of automobile gears. One large gear was tested for accuracy of tooth spacing.

New Equipment.—A comparator for long gage blocks and end standards up to 60 inches in length was made in the gage shop.

It is adapted to obtaining the difference between two blocks or end standards by interferometer methods.

To measure the errors in lead of small taper thread ring gages, a lead-testing device was designed and constructed. This device will measure the errors in lead of thread ring as small as three-fourths inch in diameter. An improved model of the lead-testing device for large thread plugs and rings was made. A device for measuring angular displacements or spacing, to an accuracy of about five minutes of arc, was purchased. This device will be used for measuring the spacing of gear teeth and for the determination of periodic errors in lead of large screws or thread gages.

Cooperation with Standardizing Bodies.—The bureau has continued its cooperation with the National Screw Thread Commission and the American Gage Design Committee. During the year pamphlets on standard threads, special threads, and plain and thread plug and ring gage blanks, for shop use, were issued as commercial standards. Cooperation with the American Petroleum Institute, in addition to gage testing, consisted mainly in establishing or revising product and master gage tolerances.

Development of a Method of Gaging Fish Nets.—At the request of the Bureau of Fisheries the bureau has undertaken an investigation of methods of measuring or gaging the mesh of gill netting. Measurements have been made on both cotton and linen cord used in gill nets to determine the magnitude and permanency of the changes in length when subjected to a tensile load with the cord either wet or dry. From the preliminary results obtained it is apparent that the conditions under which the mesh of net is to be measured must be carefully defined, and it would seem that these standard conditions should approximate the "as fished" conditions, rather than the factory conditions.

Standardization of Interchangeable Ground Glass Joints.—The gage section assisted in the standardization of ground glass joints for chemical glassware, such as distillation and extraction apparatus. The project was undertaken under the procedure of the trade standards division of this bureau, in cooperation with the leading American manufacturers, distributors, and representative users of chemical glass apparatus. Nine sizes of joints were adopted, all having a taper of 1 in 10, on diameter. Master gages for the joints obtained from European manufacturers were measured and the magnitude of the errors in taper found was such that it was considered doubtful if interchangeable joints could be made using these gages as masters. Steps have been taken to secure gages of the required accuracy made in this country.

Weights and Measures Conference.—The Twenty-third National Conference on Weights and Measures met at the bureau on June 3 to 6, with a representation of officials from 26 States. In addition to the presentation and discussion of numerous papers on technical phases of weights and measures administration, the conference adopted a tentative code of specifications and tolerances for odometers, made some slight modifications in the previously adopted codes for lubricating-oil bottles, grease-measuring devices, weighing scales, and liquid measuring devices, and adopted a partial code of

specifications for automatic-indicating scales. Attention will continue to be given to the subject of automatic-indicating scales for the next several years.

The National Conference on Weights and Measures serves to coordinate the regulatory work of the States along weights and measures lines, and is a direct medium through which bureau cooperation is extended. Reports of the conference proceedings are published, thus making available to officials of the States, to manufacturers of weighing and measuring devices, and to others interested, a permanent record of the conference transactions. During the year there was published a complete index of the reports of the several conferences from the first to the twenty-first, inclusive, whereby the wealth of weights and measures data contained in these reports is made more readily accessible.

Publication.—Weights and Measures References (Index to Reports of Conferences), B. S. Miscellaneous Publication No. 103; 1930.

VI. MUNICIPAL, COUNTY, AND STATE PURCHASING AGENCIES

It has been estimated that the combined purchases of supplies for municipal and State governments exceed three-quarters of a billion dollars annually, all of which is collected from the public in the form of taxes. This sum does not include the cost of constructing and maintaining the highways throughout the country, a considerable part of which is contributed by the United States Government in accordance with the Federal-aid road-construction plan.

The methods employed by the local governments in spending this large sum of money vary somewhat in detail although, in a majority of cases, purchasing departments have been created for the purpose of making purchases of equipment and supplies for the needs of the various governments.

Since the inauguration of the Standards Yearbook in 1927, periodic surveys have been made to determine in what way the Federal agencies can best be of assistance to State and municipal agencies who are entrusted with the expenditure of public money. Much of the information resulting from these surveys has already been set forth in previous editions of the Standards Yearbook.

There are given below brief items relating to information obtained as a result of a recent survey of the extent to which purchasing departments use the specification 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.

There is also set forth in this chapter a summary of the replies received from States to a questionnaire sent out by a committee of the American Road Builders' Association relating to the methods now employed for the regulation and control of traffic on highways.

MUNICIPAL PURCHASING AND STANDARDIZING AGENCIES

Information concerning their purchasing methods has been received from 567 municipalities, 238 of which have the city-manager form of government. About one-half of the cities reported that specifications are used in the purchase of materials, equipment, and supplies.

In the following items there are given separate brief summaries of replies received from questionnaires recently submitted to cities having city managers and those maintaining a different form of government.

In 173 cities not having city managers, purchasing agencies have been created to make purchases for all city bureaus, departments, and institutions; in 13 cities purchases are made for all units of the city government except schools; and in 29 purchases are made for public improvements only. Twenty-five cities reported that all purchases are made by the heads of each department.

Specifications are prepared by the city engineers in 186 cities and by the office of the purchasing agent in 36 other municipalities. In 50 cities they are prepared by the heads of each using department; by the board of public works in 4; and in 1 municipality they are prepared by the comptroller.

Standards and specifications of the American Society for Testing Materials are employed by 78 municipalities, 70 reported that they use State and Federal specifications, and 40 use the specifications of the American Water Works Association. Several cities stated that use is also made of the standards and specifications of the American Concrete Institute, American Electric Railway Engineering Association, American Institute of Electrical Engineers, American Institute of Steel Construction, American Society of Mechanical Engineers, American Society for Municipal Improvements, Asphalt Institute, Common Brick Manufacturers Association, National Board of Fire Underwriters, National Electric Light Association, Portland Cement Association, and the Society of Automotive Engineers. In 102 cities some purchases are made of trade-branded articles without the use of specifications, but in no case has it been reported that purchases are made exclusively on the basis of trade brands.

Forty-seven cities stated that they maintain laboratories for testing certain commodities. Commercial testing laboratories are employed by 132 cities, 81 use the laboratories of colleges and universities, and 39 use the laboratories of State highway departments and other government agencies.

In 218 cities trained inspectors are maintained for the purpose of checking deliveries to determine whether or not they comply with specification requirements.

Of the American council-manager municipalities, about 400 have adopted officially the city-manager form of government, and about 100 additional municipalities have officials holding the title, but not the full authority, of "city manager."

Below there is given a résumé of the answers to questionnaires received from 238 municipalities having city managers.

In 122 of these cities the managers make all of the purchases for the city activities; in 74 they make purchases for all activities except the public schools or libraries, and in 42 they make purchases for only a part of the city departments or institutions.

In 112 of the municipalities commodity specifications are prepared by either the city managers or by regularly appointed purchasing agents, in 60 they are prepared by the city engineers, and in 66 by several city officers.

Very widespread use is made of nationally recognized commodity specifications, although 112 of the cities prepare their own specifications for certain commodities and 119 buy partly on trade brand. Sixty-nine of the cities reported the use of State and Federal specifications, 51 those of A. S. T. M., and 35 the specifications of the American Water Works Association. Two or more cities reported the use of the standard and specifications of the American Society for Municipal Improvements, the Asphalt Institute, the National Board of Fire Underwriters, the National Electric Light Association, the Portland Cement Association, and the Underwriters' Laboratories.

Laboratories equipped for testing certain commodities are maintained by 30 cities. Eighty-five of the cities make use of commercial

testing laboratories, 80 use the laboratories of colleges, and 17 make use of the laboratories of other governmental units, such as the State highway commissions or departments.

Inspectors for enforcing compliance with specifications are utilized in 153 cities, and performance tests are resorted to in 33 municipalities.

The centralized system for combining all city purchases under one head is utilized in 105 cities, all of which attribute certain economies to this system.

COUNTY PURCHASING AGENCIES

Many of the purchasing problems of the more than 3,000 counties in the United States are similar to those of the municipalities, and solutions to these problems found satisfactory by the cities can well be applied by the counties. Among such problems are the purchase of supplies and the construction of highways, bridges, and public works.

The so-called "county-manager plan" of operation has been adopted officially in Arlington County, Va. A modification of this plan, possessing many of its essential features, is also in use in Alamance, Cleveland, Davidson, Guilford, and Robeson Counties, N. C., and in Albemarle, Augusta, Fairfax, and Pittsylvania Counties, Va.

The proposed changes in county governments, usually involving the introduction of the county-manager plan, are being given consideration in Alabama, California, Colorado, Florida, Georgia, Indiana, Iowa, Kansas, Mississippi, Missouri, North Dakota, Ohio, Oklahoma, Oregon, and South Carolina. In California, Iowa, Maine, Maryland, Montana, New Hampshire, New Mexico, North Carolina, North Dakota, Oklahoma, South Dakota, Wyoming, and Virginia, the State constitutions permit the counties to adopt such a form of government as the county-manager plan, whereas in certain other States enabling acts by the legislatures would be required.

STATE PURCHASING AND STANDARDIZING AGENCIES

In each of the 48 States and the District of Columbia there have been set up, either by legislative action or by authority of the governor, purchasing departments for the purpose of buying equipment and supplies needed for the operation of the various bureaus, commissions, departments, institutions, and other agencies of these governments.

Similar purchasing offices have also been created in many States and placed under the control of the various State highway commissions to make purchases of materials and equipment used in the construction and maintenance of highways. Several highway departments which do not maintain purchasing offices utilize the services of their respective State purchasing agents who are authorized to make all purchases for the State.

Specifications are formulated by the heads of the using departments in some States, while in other States, they are prepared by engineers and chemists in cooperation with departmental and institutional officials. In numerous instances, specifications are based on those of technical societies, trade associations, and the Federal Government.

In almost every case where commodities are purchased on specifications, provisions have been made for testing or inspection to determine whether or not the goods delivered comply with requirements set forth in the specifications.

In every State standards and specifications have been prepared for practically every type of material entering into highway construction, the specifications used being in conformity with those formulated by the American Society for Testing Materials, the American Association of State Highway Officials, and the United States Bureau of Public Roads, and formally approved by the United States Secretary of Agriculture for use in connection with Federal-aid road construction.

Many of the States use the specifications of the Federal Government in the purchase of oils and lubricants and those of the American Wood-Preservers' Association and the West Coast Lumbermen's Association in placing contracts for the purchase of lumber and creosoted products used for bridge and other highway construction.

In many cases, States have prepared their own specifications for certain lines of commodities based on the result of experience in the use of such commodities. Several of the State highway departments buy partly on trade brands, but in no case has it been reported that they purchase exclusively on trade brands.

Laboratories equipped to make either chemical or physical tests, or both, of materials are utilized by all of the State highway departments, most of whom maintain their own laboratories. At times the highway departments employ the services of commercial and university laboratories for special tests on steel, paints, and cement.

Without exception, every State maintains a force of trained inspectors whose duties are to examine material either at the sources of supply or upon arrival at destination to determine whether or not they measure up to specification requirements.

STANDARDS FOR HIGHWAY TRAFFIC CONTROL

In the following items there is given some information concerning the codes and standards now in use in the several States with respect to the regulation and control of traffic on highways. The purpose of this survey is to arrive at some basis for a standardization program for the formulation of a national uniform code relating to the installation and adoption of traffic-control signals and signs on the highways of the country. The replies received from this survey, which was conducted by a committee of the American Road Builders' Association, were analyzed and tabulated by the National Bureau of Standards.

Twenty-two States reported that they use the standard unreflectorized signs recommended by the American Association of State Highway Officials; 6 use the United States standard; and 1 the recommended standard of the American Engineering Council.

Eight States use the reflectorized signs adopted by the American Association of State Highway Officials; 4 reported that they use the "buttons and bulls' eyes" signs, and 9 replied that they make use of various types of signs.

Of the 34 States replying to the question pertaining to signals, 6 reported that they make use of the signals recommended by the

American Association of State Highway Officials, 6 States have adopted the United States standard, and 2 reported they use the A. G. A. standard. Twelve States have replied that they use no illuminated signals.

Five States replied that railroads have been influential in the acceptance and adoption of standard codes; automobile clubs in 6 other States; insurance companies in another; and 21 States reported none.

In 3 States, railroads employ a different code than that adopted by States. Various local types of codes are used in 3 other States, and in 12 States no standard code prevails.

Twelve States reported that changes were made in their standard codes regarding the recommended sizes of lettering, shape of signs, colors, or wording, while 23 States replied that they made no changes in their codes.

In 14 States, cities and villages use the same code as that adopted by State highway departments. Various codes are in use in cities and towns of 10 other States, and in the same number of additional States, the standard code is used only in certain localities.

Twelve States reported that it is necessary for towns and cities to obtain approval from State highway departments before installing signals or signs on State routes. Fourteen States replied that no approval is necessary. Cities in 2 States having a population of 2,500 or less, 3,500 or less in another, and up to 4,000 in another State, are required to obtain the necessary approval from their respective State highway departments. In another State, approval is also necessary except for the installation of traffic lights in congested districts.

Counties in 7 States use the same code on county roads as is employed for State routes, while in 13 States different codes are used. In 4 States, some counties do use the same code while others do not. Counties in 7 States do not use any codes.

Signs for use on country roads are designed by county officials in 16 States. In 3 States they are designed by State officials, and in 1 by automobile clubs. Seven States have replied that no signs are used by counties.

Commercial companies are employed for the manufacture of signs used on State routes in 14 States. In 9 they are built by State prison industries, and in 2 by the highway departments. In 4 States they are manufactured by both commercial agencies and prisons, while in 3 other States they are made by commercial, prison, and highway department agencies.

Seventeen States reported that no requirements are made in connection with the design of electric traffic control or warning signals. Thirteen States replied that their design is governed by State regulations.

Lane markers are used by 20 States on rural highways or city streets on State routes and not used in 5 other States.

Certain restrictions are placed by 33 States on nonstandard signs of other interests on State routes inside or outside of municipalities.

Seven States replied that State laws control the placing of signs and markers on highways. In 16 States, the matter is decided by various State, county, and municipal authorities, and in 8 there are no laws.

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, the names of the individuals in charge, 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. Woolsey Finnell, highway director; George L. Moulton, assistant engineer.

Arizona Board of Directors of State Institutions, Phoenix. C. M. Zander, executive officer, secretary, State purchasing agent.

Arizona State Highway Department, Phoenix. I. P. McBride, chairman of commission; W. W. Lane, 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. Jackson, purchasing agent.

California State Department of Finance, Bureau of Purchases, Capitol Building, Sacramento. J. F. Misphey, acting State purchasing agent.

California State Department of Public Works, Sacramento. Ralph W. Bull, 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. B. B. Allen, chairman of commission; L. D. Blauvelt, State highway engineer.

Connecticut State Board of Finance and Control, Hartford. Edward F. Hall, commissioner.

Connecticut State Highway Department, Portland. John A. Macdonald, State highway commissioner; Frank C. Flood, testing engineer.

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, manager.

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 Board. G. W. Barnett, chairman, Atlanta; W. R. Neel, State highway engineer, East Point.

Idaho State Bureau of Supplies, Boise. R. G. Archibald, State purchasing agent.

Idaho State Department of Public Works, Boise. J. D. Wood, commissioner of public works; R. H. Shoemaker, office engineer.

Illinois State Department of Public Works and Buildings, Division of Highways, Springfield. Harry H. Cleveland, director, department of public works; Frank T. Sheets, chief highway engineer; V. L. Glover, engineer of materials.

Illinois State Division of Purchases and Supplies, Statehouse, Springfield. L. H. Becherer, 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, executive 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. L. Niles, 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. R. W. Dole, director of highways; W. V. Buck, State highway engineer.

Kentucky State Highway Commission, Frankfort. Ben Johnson, chairman of commission; J. S. Watkins, State highway 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; W. H. Nordkauer, 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, Whitaker Building, Baltimore. Walter N. Kirkman, State purchasing agent.

Maryland State Roads Commission, Baltimore. G. Clinton Uhl, chairman of commission; H. D. Williar, jr., chief engineer; R. F. Going, purchasing agent.

Massachusetts State Department of Public Works, Statehouse, Boston. Frank E. Lyman, commissioner of public works; Arthur W. Dean, chief engineer.

Massachusetts State Purchasing Bureau, Statehouse, Boston. George J. Cronin, State purchasing agent.

Michigan State Administrative Board, Accounting and Purchasing Division, Lansing. Charles W. Foster, secretary.

Michigan State Highway Department, Lansing. Grover C. Dillman, State highway commissioner; M. DeGlopper, materials and equipment engineer.

Minnesota State Department of Highways, St. Paul. Charles M. Babcock, commissioner of highways; J. T. Ellison, chief engineer.

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 and director in charge.

Mississippi State Highway Department, Jackson. J. C. Roberts, 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. Sam A. Baker, governor.

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 Board of Control, Lincoln. O. R. Shatto, secretary.

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. Frederic E. Everett, commissioner of highways.

New Hampshire State Purchasing Department, Concord. W. A. Stone, purchasing agent.

New Jersey State Highway Commission, Trenton. Gen. H. L. Scott, chairman of commission; Jacob L. Bauer, State highway engineer.

New Jersey Statehouse Commission, Trenton. A. Harry Moore, Governor of New Jersey; A. C. Middleton, State treasurer; N. A. K. Bugbee, State comptroller; and Edward J. Quigley, State purchasing agent.

New Mexico State Highway Commission, Santa Fe. Charles Springer, chairman of commission; W. C. Davidson, State highway engineer.

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 S. Greene, superintendent of public works; Arthur W. Brandt, commissioner of highways.

New York State Division of Standards and Purchase, Albany. Frank L. Morris, superintendent of standards and purchase.

North Carolina State Budget Bureau, Raleigh. Gov. O. Max Gardner, director.

North Carolina State Highway Commission, Raleigh. R. A. Doughton, chairman of commission; John D. Waldrop, State highway engineer.

North Dakota State Board of Administration, Purchasing Department, Bismarck. J. B. Smith, State purchasing agent.

North Dakota State Highway Commission, Bismarck. G. F. Schafer, chairman; H. C. Frahm, chief engineer.

Ohio State Department of Finance, Purchasing and Printing Division, Columbus. John P. Brennan, superintendent of purchases and printing.

Ohio State Department of Highways, Columbus. R. N. Waid, director of highways; C. C. Hadden, chief engineer of maintenance.

Oklahoma State Board of Public Affairs, Oklahoma City. C. E. Dudley, chairman; J. Robert Gillam, secretary.

Oklahoma State Highway Commission, Oklahoma City. L. H. Wentz, chairman of commission; A. R. Losh, State highway engineer; A. B. Thomas, purchasing agent.

Oregon State Highway Commission, Salem. H. B. Van Duzer, chairman of commission; Roy A. Klein, State highway engineer.

Oregon State Purchasing Board, Salem. Carle Abrams, secretary and 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. Jams L. Stuart, secretary of highways; Samuel Eckles, chief engineer; W. A. Van Duzer, assistant chief engineer.

Rhode Island State Board of Public Works, Highway Department, Providence. Abram L. Atwood, chairman board of public works; G. H. Henderson, chief engineer.

Rhode Island State Public Welfare Commission, Purchasing Department, Providence. George H. Haines, purchasing agent.

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. John P. Biehn, secretary of finance and director of purchasing and printing.

South Dakota State Highway Commission, Pierre. Gov. W. J. Bulow, chairman of commission; J. Maughs Brown, State highway engineer.

Tennessee State Department of Finance and Taxation, Division of Purchasing, Nashville. A. D. Curtis, State purchasing agent.

Tennessee State Department of Highways and Public Works, Nashville. Robert H. Baker, commissioner; T. C. McEwen, chief engineer.

Texas State Board of Control, Division of Purchasing, Austin. Sumner M. Ramsey, secretary.

Texas State Highway Commission, Austin. R. S. Sterling, chairman; Gibb Gilchrist, State highway engineer.

Utah State Board of Supplies and Purchase, Salt Lake City. E. R. Miles, executive secretary.

Utah State Road Commission, Salt Lake City. Henry H. Blood, chairman; H. S. Kerr, chief engineer.

Vermont State Department of Finance, Purchasing Department, Montpelier. J. L. Wallace, State purchasing agent.

Vermont State Highway Department, Montpelier. George Z. Thompson, chairman; H. E. Sargent, chief engineer.

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, State purchasing agent.

Washington State Department of Business Control, Division of Purchasing, Olympia. H. D. 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. C. A. Jackson, board member; John A. Wade, general purchasing agent.

West Virginia State Road Commission, Charleston. C. P. Fortney, chairman; A. S. Winter, purchasing agent.

Wisconsin State Bureau of Purchases, Madison. F. X. Ritger, superintendent.

Wisconsin State Highway Commission, Madison. Jerry Donohue, chairman; W. 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. Severson, State highway engineer.

The first of these is the fact that the United States is a young nation, and its history is therefore a history of growth and development. The second is the fact that the United States is a large nation, and its history is therefore a history of expansion and conquest. The third is the fact that the United States is a diverse nation, and its history is therefore a history of conflict and compromise. The fourth is the fact that the United States is a nation of immigrants, and its history is therefore a history of assimilation and integration. The fifth is the fact that the United States is a nation of pioneers, and its history is therefore a history of exploration and discovery. The sixth is the fact that the United States is a nation of inventors, and its history is therefore a history of innovation and progress. The seventh is the fact that the United States is a nation of leaders, and its history is therefore a history of vision and leadership. The eighth is the fact that the United States is a nation of heroes, and its history is therefore a history of courage and sacrifice. The ninth is the fact that the United States is a nation of dreamers, and its history is therefore a history of hope and aspiration. The tenth is the fact that the United States is a nation of believers, and its history is therefore a history of faith and conviction.

The history of the United States is a story of a nation that has grown from a small colony to a great power. It is a story of a nation that has expanded its territory and its influence across the world. It is a story of a nation that has fought for its freedom and its rights. It is a story of a nation that has made great contributions to the world. It is a story of a nation that has inspired the world. It is a story of a nation that has shown the world what is possible. It is a story of a nation that has led the world. It is a story of a nation that has changed the world. It is a story of a nation that has made the world a better place.

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VII. GENERAL STANDARDIZING AGENCIES

Among the organizations in the United States which are at the present time conducting work in the field of standardization are four which make standardization or work closely related thereto, the major feature of their activities, namely, the American Standards Association, American Marine Standards Committee, American Society for Testing Materials, and the Central Committee on Lumber Standards.

Through cooperation with technical societies, trade associations, governmental bodies, private and industrial concerns, and others interested in standardization these four agencies are actively engaged in the formulation of standards, specifications, codes, and methods of test in order to aid in the development of the work in standardization in the various major fields of industry.

In the present chapter are set forth outlines of the standardization activities of these organizations with special reference to their accomplishments during the past year. Additional information concerning the functions and procedures of their committees engaged in the preparation of standards and specifications can be found in previous editions of the Standards Yearbook.

Information relating to the standardization activities and accomplishments of commercial, scientific, and technical agencies in their respective fields are set forth in Chapter VIII.

The activities of the National Bureau of Standards and of other agencies of the Federal Government in matters relating to simplification and standardization are outlined in Chapters V and IV, respectively.

Sketches relating to the standardizing activities of State and municipal purchasing agencies, including State highway departments, with reference to their methods for purchasing materials, equipment, and supplies are set forth in Chapter VI.

AMERICAN STANDARDS ASSOCIATION

The American Standards Association is a federation of 45 national technical societies, trade associations, and governmental bodies. The chief purpose of the association is to bring together manufacturers, distributors, consumers, technical specialists, and any others directly concerned with a particular standardization project; to assure that a preponderance of these interests wishes to have a national standard; to bring about the organization of a technical committee composed of official delegates of all important bodies directly interested to formulate the standard; and finally, when such a committee has prepared or selected the standard and given it substantially unanimous approval, and the American Standards Association is definitely assured that the standard represents a real national consensus, to make it an "American Standard."

Participating in the association's work, through some 2,200 officially accredited representatives, are 550 national organizations—technical, industrial, and governmental. Of these nearly 200 are trade associations. Subscribing directly to its support are about 400 organizations and firms interested in its work and listed as sustaining members. The member bodies of the association are organizations or groups of organizations having an important interest in standardization.

The association maintains a technical staff in its headquarters at 29 West Thirty-ninth Street, New York, N. Y. Dr. P. G. Agnew is the secretary. The actual work of establishing standards is carried on by technical committees representing the producing, distributing, and consuming groups concerned with the projects. In fact, a basic requirement of the American Standards Association procedure is that no standards shall be approved unless all important interests have been adequately represented in the establishment of the standard, no one interest predominating in influence except with the consent of the other groups. The initiation of standardizing projects may be brought about at the request of any responsible body.

The association provides a procedure under which national standards may be established by any industry or group of industries with the assurance that the standards will represent a true national consensus of approval. National standards have been prepared under American Standards Association auspices or are now under way in almost every major field of industrial activity.

In addition to providing systematic means by which organizations concerned with standardization may cooperate in establishing American standards, the American Standards Association serves as a clearing house for information on standardization work, both in the United States and abroad. The association also acts as the authoritative channel in international cooperation in standardization work.

There are four general methods of procedure under which American standards may be formulated and approved, as follows: Sectional committee, existing standard, proprietary, and general acceptance. Under the first method, a joint technical committee known as a sectional committee is formed, composed of designated representatives of all vitally interested groups concerned with the subject being considered for standardization. Such technical committees may work either under the administrative support and direction of a sponsor body, or autonomously, reporting direct to the A. S. A. As to the second, the existing standards method, it provides that existing standards may be approved when it is shown by proper exhibits of the submitting body that the standard represents a true consensus of competent industrial opinion with respect to its suitability for national adoption. In connection with the third method, 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 A. S. A. when it is shown by methods set down in the procedure that such a standard is supported by a consensus of those substantially concerned with its development and use. A fourth method especially applicable to simple cases not requiring continued technical consideration is known as the general acceptance method. Under this procedure a conference of those principally concerned—producers, consumers, and other

competent interests—is held. The decision of the conference is authenticated and supported by a sufficiently large number of written acceptances of the conference's recommendation, from those substantially concerned with the scope and provisions of the recommendation.

Under all these methods of procedure the project is undertaken, as has been outlined, only upon the formal proposal of a responsible industrial, commercial, governmental, or technical group.

The American Standards Association handles each year over a thousand requests for various types of technical information. In answering these requests the office not only makes available the material in its files, but also collects information from numerous technical and trade organizations in the United States and Europe.

The American Standards Association Bulletin, which is sent monthly to sustaining members, contains a review of all important developments during the previous month, carries abstracts of articles on standardization appearing in foreign and American publications, and notes important books and pamphlets, most of which are available to sustaining members.

The bulletin carries a supplement on standardization within companies which is proving of great value to many manufacturers and others in organizing and improving their companies' standardization work. Sustaining members are also given the privilege of reviewing drafts of proposed American standards and of making known their comments on these standards to the technical committees which prepared them.

The American Standards Association is in constant touch with 20 national standardizing bodies in foreign countries. Information concerning new projects, draft standards, and new standards is constantly exchanged among all the standardizing bodies. Each body maintains a file of, and acts as sales agent for, the approved standards of other countries, thus making these standards readily available to the industries of each country. Since the latter part of 1929 the A. S. A. has been a member of the International Standards Association, the international organization for cooperation in the development of industrial standards, which has its headquarters at Basle, Switzerland. The International Standards Association now includes 18 national standardizing bodies in its membership.

Under the auspices of the American Standards Association, 168 standardization projects have been carried forward to completion as approved standards, and 173 additional projects are in various stages of progress. In the accompanying table is shown the distribution of these projects among the industrial groups:

| Group | Number of projects | Projects approved | Group | Number of projects | Projects approved |
|--|--------------------|-------------------|---------------------|--------------------|-------------------|
| Civil engineering and building trades..... | 39 | 19 | Chemical..... | 13 | 11 |
| Mechanical..... | 99 | 35 | Textile..... | 5 | 2 |
| Electrical..... | 62 | 25 | Mining..... | 18 | 10 |
| Automotive..... | 5 | 4 | Wood..... | 5 | 4 |
| Transportation..... | 10 | 10 | Pulp and paper..... | 2 | 1 |
| | | | Miscellaneous..... | 66 | 38 |
| Ferrous metallurgy..... | 3 | 2 | | | |
| Nonferrous metallurgy..... | 14 | 7 | Total..... | 341 | 168 |

The following is a list of the standards approved by the American Standards Association since the last issue of the Standards Yearbook.

Civil engineering.—Building exit code; specifications for putty; method of tests for toughness of rock; methods of sampling stone, slag, gravel, sand and stone blocks for use as highway material; methods of test for penetration of bituminous materials; standard methods of float tests for bituminous materials; and standard method of test for determination of bitumen.

Mechanical engineering.—Milling cutters; dimensions of cut and ground thread taps; annular ball bearings (single row type); ball and roller bearings (wide type); slotted head machine screws and wood screw heads; and safety code for the use, care, and protection of abrasive wheels.

Electrical engineering.—National electrical code (C1); dimensions governing fits of 4-pin vacuum tube bases and arrangement of terminals; and specifications for outlet boxes.

Chemical industry.—Methods of routine analysis of white pigment; method of routine analysis of dry red lead; methods of laboratory sampling and analysis of coal and coke; identification of gas mask canisters; and specifications for liquid soap.

Textile industry.—Safety code for textiles.

Wood industry.—Safety code for woodworking plants.

Mining.—Use of explosives in bituminous coal mines.

Miscellaneous.—Symbols for telephone and telegraph use; symbols for hydraulics; pulverizing systems for sugar and cocoa; method of test for saponification; method of test for detection of free sulphur and corrosive sulphur compounds in gasoline; and aeronautical symbols.

New projects given official status by or proposed to the American Standards Association since the last issue of the Standards Yearbook include:

Mechanical engineering.—Standardization of foundry equipment; specifications for industrial thermometers.

Chemical engineering.—Specifications for fuel oils.

Mining.—Safety rules for installing and using electrical equipment in metal mines.

Miscellaneous.—Approval and installation requirements for domestic gas-burning appliances; safety code for grandstands; method of test for melting point of petrolatum; method of test for the determination of autogenous ignition temperatures of liquid and semiliquid petroleum.

The membership of the American Standards Association has been increased during the past year by the admission of the Manufacturers Standardization Society of the Valve and Fittings Industry, the National Coal Association, the Radio Manufacturers Association, the Institute of Radio Engineers, and the Small Tool Group consisting of the Drill and Reamer Society, the Milling Cutter Society, and the Tap and Die Institute.

AMERICAN MARINE STANDARDS COMMITTEE

This committee was organized primarily to promote simplification of practice and elimination of waste in the construction, operation, and maintenance of ships and port facilities by formulating and promulgating standards of design and practice where such are deemed of economic importance. It is national in scope and comprises shipyards, ship repair and docking establishments, ship owners and operators, naval architects, marine engineers, manufacturers of marine materials and appliances, and generally educational, commercial, and Government interests related to the industry.

The organization is controlled by its membership through the annual election of an executive board. 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 Building, Washington, D. C.; A. V. Bouillon is the secretary.

As of July 1, 1930, the membership comprised 360 member bodies, and there were several applications for enrollment to be considered at the next meeting of the executive board.

The technical branch of the organization comprises four technical committees, the functions of which are advisory, and numerous subject committees, the functions of which are to develop standards in their early stages. Proposals for international marine standards are reviewed and recommendations are made on them by a special standing committee. Another special committee has the function of passing upon questions which may arise among users of the standards.

Coordination is effected with the work of other national standardizing bodies through representatives of the American Marine Standards Committee in committees of the American Standards Association and representatives of other organizations appointed as advisory members of the executive board of the American Marine Standards Committee by the following organizations: American Institute of Electrical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, National Bureau of Standards, and National Fire Protection Association.

The committee had promulgated 124 standards prior to July 1, 1930, which have been or are being published in a series of publications issued by the Department of Commerce. Twenty-two standards were promulgated during the year ending June 30, 1930, as follows:

Hull details.—Oval mooring pipes; circular mooring pipes; metal frame berths, shallow type; metal frame berths, deep type; light-stanchion type of support for fixed-berth standees; heavy-stanchion type of support for hinged-berth standees; chain lugs for hinged-berth stanchions; hook for hinged berths; wall-bracket type of berth supports; wall-box type of berth supports; locks and accessories for ship doors; bolts and catches for ship doors; and sash hardware for ships.

Engineering details.—Solid sleeve couplings for propeller shafts; split sleeve couplings for propeller shafts; fair-water caps for propeller hubs on ships fitted with a contrapropeller or a streamline rudder; molded insulation coverings for temperatures over 550° F.; diatomaceous earth, granular, calcined; and brick and mortar, insulating.

Ship operation details.—Standard wire ropes for marine uses; care and operation of oil-burning apparatus and handling of fuel oil on ships; and uniform outfits for merchant marine officers—specifications for garments and insignia. The committee also promulgated a revised standard specification for 2½-inch unlined linen fire hose to supersede its Standard O No. 4-1926 in order to specify this product in accordance with the latest manufacturing practice and testing methods.

The committee's current activities include proposed standards to cover practice in hull construction; fittings for oil-tight hatches; hinged water-tight doors; standard sockets for hatch beams; supply and exhaust cowls and fittings for natural ventilation; air ports;

cleats; ladders and gratings; deck drain with stop valve; steel for ship construction; standard steel shapes for shipbuilding; numerous items of joiner hardware; fair leader and cleat for boom topping lift; flanged pipe fittings and pipe flanges for three zones of pressures up to 400 pounds; water-tight receptacles. They also include revisions of condenser tube ferrules and tube sheets; table glassware; care and operation of Diesel machinery; bollards and cleats for docks; reinforced concrete piles for wharves and piers; structural steel cargo masts for docks; and platform cargo slings.

AMERICAN SOCIETY FOR TESTING MATERIALS

Work of the society in the promotion of the knowledge of materials of engineering and the standardization of specifications and the methods of testing is carried out through the activities of its 50 technical committees, having a total membership of about 2,400, appointed to study the properties of the various engineering materials. The work is done in two ways: First, in the reporting of technical and scientific data to the society by its committees in the form of papers and discussions that are published in proceedings, and second, in the activities of the committees appointed to develop and study new information on the properties of materials. The committees are responsible for the development of standard specifications and methods of testing which is a most important function of the society. The committees function under definite regulations governing the organization of committees and the procedure in preparing standards to insure adequate representation and voice of all parties interested in any standard. The society headquarters are at 1315 Spruce Street, Philadelphia, Pa. C. L. Warwick is the secretary-treasurer.

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 at the annual meetings of the society. Recent annual meetings have included such outstanding topics as aircraft materials, engineering properties of cast iron, properties of mineral aggregates, and the uses of rosin, each treated in an extensive symposium; corrosion and corrosion fatigue studies of materials; the properties of metals at high temperatures; wear tests of metals; papers on nonferrous sheet metals; die-casting alloys; bearing bronzes; electrical heating wires; significance of proportional limit; extensive studies of strength, elastic properties, and durability of concrete; thermal transmission of fabrics; testing of cement; paints, gasoline, and motor oils; and many papers describing testing apparatus and methods.

The development of standards covering the following engineering materials may be cited as among the current activities of the society as being of outstanding importance: For metals for high-temperature service; welded steel piping; zinc-coated and other metallic-coated products for increased resistance to corrosion; magnetic testing and analysis of metals; ferro-alloys; iron-chromium, and iron-chromium-nickel and related alloys; electrical-heating, electrical-resistance, and electric-furnace alloys; die-cast metals and

alloys; screen wire cloth; metallographic testing, thermal analysis and radiographic testing of metals; cement; concrete and concrete products; lime and gypsum; brick; hollow tile; mortars for unit masonry and other ceramic products; refractory materials; preservative coatings, including paints, varnishes, pigments, vehicles, and paint thinners; petroleum products and lubricants; road and paving materials; waterproofing and roofing materials; electrical insulating materials; coal and coke; timber and timber preservatives; shipping containers; rubber products, textile materials; thermometers; slate; naval stores; and natural building stones.

In the following table are shown the number of standards and tentative standards adopted in the year 1930 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:

| | Adopted in 1930 | | | Total adopted to date | |
|---|-----------------|----------------------------------|---------------------|-----------------------|---------------------|
| | Standards | Tentative revisions of standards | Tentative standards | Standards | Tentative standards |
| A. Ferrous metals..... | 13 | 18 | 2 | 104 | 12 |
| B. Nonferrous metals..... | 2 | 2 | 7 | 66 | 13 |
| C. Cement, lime, gypsum, concrete, and clay products..... | 8 | 11 | 5 | 61 | 16 |
| D. Miscellaneous materials..... | 21 | 23 | 15 | 186 | 109 |
| E. Miscellaneous subjects..... | 1 | 1 | ----- | 10 | 5 |
| Total..... | 45 | 55 | 29 | 427 | 155 |

The society adopted the following standards and tentative standards in 1930:

A. Ferrous metals.—Standard specifications for open hearth carbon steel rails; steel tie plates; billet steel concrete reinforcement bars; iron and steel, chain; steel forgings; welded and seamless steel pipe; steel plates of structural and flange quality for forge welding; lap-welding and seamless steel and lap-welded iron boiler tubes; commercial quality hot-rolled bar steels and cold finished bar steels and shafting; refined wrought-iron bars and plates; welded wrought-iron pipe; wrought-iron blooms and forgings for locomotives and cars; staybolt, engine-bolt, and extrarefined wrought-iron bars; hollow rolled staybolt iron; gray-iron castings for valves, flanges and pipe fittings; malleable castings; zinc-coated (galvanized) wire fencing, barbed wire, steel wire strand; iron or steel tie wires; telephone and telegraph line wire; zinc-coated chain link fence fabric galvanized after weaving and zinc (hot galvanized) coatings on structural steel shapes, plates, and their products.

Standard methods of sampling rolled and forged steel products for check analysis; methods of determining weight of coating on zinc-coated articles and testing zinc-coated (galvanized) iron and steel wire and wire products.

Standard definitions of terms relating to wrought-iron specifications and terms relating to heat-treatment operations (especially as related to ferrous alloys).

Tentative specifications for austenitic manganese-steel castings; and open-hearth iron plates of flange quality.

B. Nonferrous metals.—Standard specifications for bronze trolley wire; round and grooved hard-drawn copper trolley wire; and seamless copper tubes.

Standard method of test for change of resistance with temperature of electrical heating materials.

Tentative specifications for aluminum alloy (duralumin) sheet; aluminum manganese alloy sheet; magnesium-base alloy castings; aluminum-base casting

alloys in ingot form, aluminum-base alloy castings; and copper-base alloys in ingot form for sand castings.

Tentative method of test for thermoelectric power.

C. Cement, lime, gypsum, concrete, and clay products.—Standard specifications for Portland cement; paving brick; building brick (made from clay or shale); sand-lime building brick; hollow burned clay floor tile; hollow burned clay load bearing wall tile; hollow burned clay fireproofing, partition and furring tile; calcined gypsum; gypsum plasters; gypsum molding plasters; gypsum pottery plaster, gypsum plastering sand; gypsum plaster board; Keene's cement; calcined gypsum for use in the preparation of dental plasters.

Standard methods of testing cement; gypsum and gypsum products; test for approximate apparent specific gravity of fine aggregate; approximate percentage of voids in inundated fine aggregate; and surface moisture in fine aggregate.

Tentative specifications for high early strength Portland cement; reinforced concrete pipe; reinforced concrete culvert pipe, concrete aggregates; gypsum sheathing board.

Tentative laboratory method of making flexure tests of concrete using a simple beam with center loading.

Tentative definitions of terms relating to heat transmission of refractories.

D. Miscellaneous materials.—Standard specifications for lampblack; bone black; high-carbon tar for surface treatment, cold application; low carbon tar for surface treatment, cold application; high-carbon tar for surface treatment, hot application; low carbon tar for surface treatment, hot application; high carbon tar cement; low carbon tar cement; coal-tar pitch for stone block filler; acid resisting asphalt mastic; gravel for bituminous concrete base; structural wood joists and planks, beams, and stringers, and posts and timbers; tolerances and test methods for tire fabrics other than cord fabrics; tolerances and test methods for tire cord woven and on cones.

Standard methods of routine analysis of white pigments; analysis for the color characteristics of paints in terms of fundamental physical units; test for distillation of gasoline, naphtha, kerosene, and similar petroleum products; test for viscosity of petroleum products and lubricants; test for water in petroleum products and other bituminous materials; test for water and sediment in petroleum products by means of centrifuge; test for cloud and pour points of petroleum products; test for burning quality of kerosene oils; test for carbon residue of petroleum products (Conradson carbon residue); test for distillation of natural gas gasoline; test for burning quality of long time burning oil for railway use; test for burning quality of mineral seal oil; test for detection of free sulphur and corrosive sulphur compounds in gasoline; test for melting point of petrolatum; test for the determination of autogenous ignition temperatures; test for loss on heating of oil and asphaltic compounds; test for distillation of bituminous materials suitable for road treatment; methods of laboratory sampling and analysis of coal and coke; test for fineness of powdered coal; test for sieve analysis of crushed bituminous coal; sampling and analysis of creosote oil; test for coke residue of creosote oil; test for distillation of creosote oil; testing molded insulating materials; testing electrical porcelain; and test for determination of toluol insoluble matter in rosin (chiefly sand, chips, dirt, and bark).

Standard definitions of terms relating to coal and coke; terms relating to timber; terms relating to textile materials.

Tentative specifications for glazier's putty; amyl acetate (synthetic); amyl alcohol (synthetic); butyl propionate (90 to 93 per cent grade); ethyl lactate (synthetic); soluble nitrocellulose; timber piles; calcium chloride for dust prevention; thermometers for Engler viscosimeters; and chafer tire fabrics.

Tentative methods of sampling and testing lacquer solvents and diluents; test for dilution of crank-case oil; test for determination of vapor pressure of natural gasoline (Reid method); methods of sampling petroleum and petroleum products; method for the specific gravity, 38°/15.5° C., of creosote fractions; methods of testing asphalt roll-roofing surfaced with fine talc, granular talc or mineral granules, likewise asphalt shingles surfaced with mineral granules; method of compression testing of natural building stone; flexure testing of natural building stone; test for absorption and apparent specific gravity of natural building stone; testing insulating varnishes; testing untreated insulating paper; and test for comparing the thermal conductivities of solid electrical insulating materials.

Tentative definition of the term coke; and of terms relating to timber preservatives.

E. Miscellaneous subjects.—Standard rules governing the preparation of micrographs of metals and alloys, including recommended practice for photography as applied to metallography.

Standard definitions of terms relating to methods of testing.

Cooperation with American Standards Association.—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 39 standardization projects or sectional committees, and 51 of its standards have been approved and 15 are under consideration for approval by the American Standards Association.

Means of Encouraging or Facilitating the Use of Standards.—For ease of reference the standards of the society are published in both separate pamphlet form and collectively in a book of A. S. T. M. standards and a book of A. S. T. M. tentative standards. In this way the standards reach those who are principally interested in the use of specifications, methods of testing, and definitions of engineering materials. In addition, special pamphlets containing the standards applying to a specific field are given widespread distribution.

The bound publications are furnished with complete subject indexes. The society issues annually a combined subject index of all American Society for Testing Materials standards and tentative standards. The index is a compilation, under appropriate key words, of titles of American Society for Testing Materials standards and tentative standards, together with the volume references to the publications in which they appear. The index is designed to be of service to those unfamiliar with the society's standards in locating any specification or method of test in the bound publications in which it appears, and, as well, to those interested in ascertaining if the society has issued any standards on a specific subject.

Permission to reprint any of the standards of the society may readily be obtained from the executive committee of the society. In this way the standards have been reprinted in full in many textbooks, and a number of specifications have received widespread distribution, sometimes totaling 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, and in the building code of many of the municipalities of the country.

A committee is 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, bringing 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 National 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; seasoning 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 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 the Department of Commerce.

The central committee has completed the formulation of softwood standards. The principal accomplishments of the past year were revisions in the heretofore published standards indicated as desirable by the practical experience in their application throughout the last five years by manufacturers, distributors, and consumers. 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.

Future work includes the consideration of technical questions arising in connection with the softwood standards; further work on hardwood standardization; revision of the present American standard series of moldings further to conform to practical manufacture and good architecture; 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. 16, through the lumber trade press, by correspondence, and through the associations and organizations representing the various branches of the industry. The central committee periodically circularizes the industry to determine the extent to which producers, distributors, and consumers are complying with the standards.

VIII. STANDARDIZING ACTIVITIES OF TECHNICAL SOCIETIES AND TRADE ASSOCIATIONS

In this chapter there is presented a picture of the standardization movement in various fields of industry conducted by trade associations, scientific and technical agencies, and other organizations which make standardization one of the important features of their services to their members.

In the accompanying outlines relating to the standardization activities of these organizations, special attention has been paid to the current standardization programs, 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 the previous editions of the Standards Yearbook.

A special effort has been made to include in the following sketches the methods employed by various organizations for making their standards and specifications effective throughout the industry and to determine whether or not their requirements are being complied with.

In the accompanying items there are reproduced outlines of the standardization activities and accomplishments of 371 organizations, representing 38 more than appeared in the 1930 Standards Yearbook, together with incidental references to 55 additional organizations that are cooperating to a limited extent in the standardization movement.

Simplified practice recommendations and commercial standards referred to in the text are those which have been established by the interested industries under the auspices of the divisions of simplified practice and trade standards of the National Bureau of Standards.

Where the term "sectional committee" is employed, the reference is to a regularly organized sectional committee functioning under the rules of procedure of the American Standards Association, unless otherwise indicated.

STANDARDIZING AGENCIES ALPHABETICALLY ARRANGED

Abrasive Paper and Cloth Manufacturers Exchange, R. P. Carlton, chairman, standardization committee, care of Minnesota Mining & Manufacturing Co., 797 Forest Street, St. Paul, Minn. All work relating to standardization and simplification matters in the abrasive industry is carried on by the standardization committee appointed by the exchange. During the 15 years of its existence, the committee has undertaken studies on numerous projects with respect to standardization and simplification of raw materials used in making coated abra-

sives, and the development of suitable and uniform specifications covering such items as paper backings, cloth backings, abrasives, and adhesives. The exchange sponsored the movement which resulted in the formulation and adoption of the simplified practice recommendation relating to coated abrasive products. The exchange has also established standard grain sizes for various abrasive products and standard methods used for testing raw materials or finished products. During the past two years, the standardization committee undertook a study of the

coating of abrasives on the regular or closed type of coating as well as the open type where the grains are separated from each other. The results of this study led to the adoption of sand weight tolerances so that the products as manufactured by the various firms will correspond both in coating and in grade.

Aeronautical Chamber of Commerce of America (Inc.), Luther K. Bell, secretary, 10 East Fortieth Street, New York, N. Y. This organization is cooperating very closely with the Society of Automotive Engineers in the standardization of materials and parts for aircraft construction. Under the auspices of the United States Department of Commerce and in cooperation with various universities and technical schools, the committee on standard performance testing of the chamber has completed a procedure for flight testing which provides for a common basis on which all manufacturers can compute their performance data. A standard aviation cable code is now being compiled by the export committee of the chamber. It is officially represented on the sectional committee on aeronautic safety code.

Agricultural Insecticide and Fungicide Manufacturers Association, G. B. Heckel, secretary, Public Ledger Building, Philadelphia, Pa. The simplified practice recommendation relative to the elimination of unnecessary sizes and the adoption of standard package sizes for insecticides and fungicides was sponsored by this association. It has also adopted the standards for lime-sulphur solution and Bordeaux mixture. These are now in general use throughout the industry.

American Association for the Advancement of Science and Associated Societies, Burton E. Livingston, permanent secretary, Smithsonian Institution Building, Washington, D. C. Standardization in scientific research constitutes one of the activities of this association. The association is one of the sponsors for the sectional committee on scientific and engineering symbols and abbreviations and is officially represented on the committee of definitions of electrical terms. It cooperates with the National Research Council and many special scientific societies in the advancement of science and in the encouragement of scientific research.

American Association of Cereal Chemists, M. D. Mize, secretary-treasurer, 833 Omaha Grain Exchange,

Omaha, Nebr. One of the principal objects of this association is the study of analytical methods used in cereal chemistry and the development of standard methods of examination and analysis. All of the work relating to standardization matters is carried on by various committees appointed by the association. Within the past two years the committee on standardization of laboratory baking has formulated a tentative standard method relating to laboratory baking tests. The committee on methods of testing cake and biscuit flours is still engaged in standardizing methods for testing cake and biscuit flours. The association has also appointed a committee on methods of chemical analysis to carry forward the work of revising and bringing down to date its publication entitled "Methods of Analysis of Cereals and Cereal Products." In order to concentrate the work and accumulate data with the object of establishing an official method of laboratory baking, this association has established a fellowship at the University of Nebraska during the scholastic year 1930-31.

American Association of Medical Milk Commissions (Inc.), Harris Moak, secretary, 360 Park Place, Brooklyn, N. Y. Standard methods of bacteriological and chemical examinations of milk to determine quality and purity, medical inspection of employees handling milk, sanitary inspection of farms and their equipment, and veterinary inspection of herds constitute important activities of this association. Dairymen complying with the association's standard methods are permitted to use the seal on milk bottles bearing the term "certified milk."

American Association of State Highway Officials, W. C. Markham, secretary, National Press Building, Washington, D. C. Standing committees of this association cooperate with the American Society for Testing Materials and other bodies in the formulation of standards and specifications pertaining to highway construction. The association has approved and adopted standards for gravel used in Portland cement concrete, standards of practice for general road design, specifications for bituminous filled brick pavement; and other specifications dealing with material and equipment used in highway construction and maintenance. Many of the specifications adopted by this association have been approved by the United States Secretary of Agriculture as standards for use in connection with Federal and

highway construction and by the State highway departments. During the past year, this association revised some of its existing standards relating to practice in road design, and the form and use of construction joints. It adopted definite standards of practice relating to maintenance of detours, minimum width of the graded section of unpaved roadways (where traffic exceeds 500 vehicles per day), color design of the standard "stop" sign, maximum percentage of road grade in connection with grade-crossing eliminations, and standardization of punchings in the mold boards on graders and maintainers. It also adopted the proposed tentative specifications for the bin batcher type of equipment for weighing concrete aggregates recommended by the association's committee on materials; and specifications citing the percentage of wear for slag. The association cooperated with the American Automobile Association and the National Bureau of Standards on the safety code for automobile brakes and brake testing. It is officially represented on the joint concrete culvert pipe committee. It is also officially represented on the sectional committees on specifications for Portland cement and drain tile, and methods of testing road and paving materials.

American Association of Textile Chemists and Colorists, Alex. Morrison, secretary, care of American Woolen Co., Andover, Mass. Standardization and research in chemical processes and application of dyes and chemicals to materials manufactured in the textile industry are the main features of the work of this association. It cooperated in the preparation of general specifications for dyed textiles and in the construction of a machine for testing the fastness to washing of these materials. It is still actively cooperating with the British Society of Dyers and Colorists toward the establishment of international standard methods of dye testing. As regards its research work, this association has perfected standard methods for testing fastness of all sorts of dyed textiles to all color-destroying agencies, such as acid, alkalis, carbonizing, crocking, chlorine staining, dry and wet heat, perspiration, waterproofing, fulling, scouring, washing, and light. During the past year work has been completed in the development of standard methods for determining minute quantities of metals, such as copper, manganese, and iron in textile

materials for the purpose of determining their suitability for rubberizing; also standard methods for determining sizing and finishing materials in textile fabrics. At present it is undertaking studies relating to the shrinkage of textile materials, and also of materials for the construction of dyeing, bleaching, and finishing apparatus. The association maintains a research associate at the National Bureau of Standards assisting in a study of methods for testing fastness to light and dyed fabrics.

American Automobile Association, Ernest N. Smith, executive vice president, Pennsylvania Avenue at Seventeenth Street NW., Washington, D. C. This organization is much interested in establishing definite standards of automobile safety and in the enactment of laws, ordinances, rules, and regulations relating to the use of motor vehicles and the rights and privileges of the owners and users thereof. It is a founder member and one of the financial backers of the National Conference on Street and Highway Safety. It has indorsed and is now urging its 1,073 affiliated motor clubs to sponsor both the uniform vehicle code and the model municipal traffic ordinance. It has adopted a code for the promotion of safe driving and the removal of irresponsible drivers from the highways, and has promulgated the model A. A. A. safety responsibility bill for adoption by all States in lieu of compulsory automobile liability insurance. More than a third of the motor-vehicle owners in the United States and half of those in Canada now operate under one or more of its essential principles. 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 in 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. It has been applied to the safety lessons now reaching 3,000,000 school children, as well as the rules under which 175,000 patrolmen now operate in 500 cities. In cooperation with the National 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 National Bureau of Standards for the sectional committee on safety code, automobile brakes, and brake testing, and is officially represented on the sectional committee for a code of street traffic signs, signals, and markings. It has promoted the construction and maintenance of standard highways and as early as 1910 it held the first Federal-aid highway convention in this country, and from that time to the enactment of the Federal-aid highway act in 1916, it carried on an aggressive campaign to bring about the enactment of this comprehensive legislation and has stood guard against all efforts for its repeal. The initiative was also taken in the successful effort to have Congress increase the Federal appropriation for Federal-aid from \$75,000,000 to \$125,000,000, and the increase has already been reflected in road building. It has urged the enactment of Federal legislation to protect the public interests in the building of private toll bridges and private toll roads. It began the fight which resulted in a repeal of the war excise tax on automobiles, and advocates standardization of automobile taxes to be levied only by States. Each year this association issues a standard set of touring maps and handbooks covering the entire country, thereby eliminating the individual publications formerly issued by each of its affiliated clubs. 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. 290.)

American Bleached Shellac Manufacturers Association (Inc.), R. W. McClintock, secretary, 80 Cliff Street, New York, N. Y. In addition to a code of ethics and a uniform sales contract, this association has formulated standard specifications for bleached shellac, also standard methods for determining penalties on excess moisture in dried bleached shellac, and arsenic in shellacs that contain small traces of this component. 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.

American Boiler Manufacturers Association, A. C. Baker, secretary, 801 Rockefeller Building, Cleveland, Ohio. Standard definitions for "setting height" for different types of boilers, charts for determining stack dimensions, and standards formulated by the Boiler Code Committee of the American Society of Mechanical Engineers have been adopted by this association. It is officially represented on three sectional committees on bolt, nut, and rivet proportions; wire and sheet metal gages; and 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. Problems arising in connection with standards and recommended practices for the operation of beverage plants, and materials and equipment used therein are studied by various committees of the Beverage Allied Industries Council, comprising manufacturers of machinery and supplies used by beverage manufacturers. This council is composed of associate members of the association. All reports formulated by committees are referred to the particular section of the council with which each committee is affiliated. Upon approval by the section the reports are submitted to a general committee consisting of three supply manufacturers and three bottlers for consideration and approval. Recommendations of this committee are in turn submitted to the executive board

of the association for final approval and adoption as standards. The association has adopted standards relating to the following items: Bottle boxes, water supply lines for carbonators, 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. It has also formulated and adopted recommended practices dealing with rubber hose and block tin tubing (diameters); compression coupling, carbonated water and sirup valves; carbonating equipment units; bottle simplification; gas volume test; and gas volume chart.

American Brush Manufacturers Association, George A. Fernley, secretary, 505 Arch Street, Philadelphia, Pa. This association assisted in the formulation of the simplified practice recommendation covering floor sweeps and paint and varnish brushes. Committees of this association are likewise attempting to bring about a simplification in other lines. The association is now engaged in developing a recommendation on Dutch kalsomine brushes.

American Bureau of Shipping, Charles A. McAllister, president, John W. Cantillon, secretary, Stevenson Taylor Memorial Building, 24 Old Slip, New York, N. Y. This bureau collaborates with other interested bodies, notably the Federal Specifications Board, American Marine Standards Committee, United States Navy Department, Association of American Steel Manufacturers, and the Society of Naval Architects and Marine Engineers, in the preparation of standards for materials, fittings, equipment, and structural methods. It promulgates rules for buildings and classing vessels which comprise general requirements for the hull structure, machinery, and deck equipment. The bureau is officially represented on the sectional committees on specifications for structural steel shapes, on screw threads for hose couplings (other than fire-hose couplings), and on standardization of dimensions and materials of wrought-iron and wrought-steel pipe and tubing.

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 the research department of the American

Welding Society and also as the welding research department of the National Research Council. The work of the bureau is conducted by research committees which handle specific problems pertaining to welding. Several committees are at present engaged in the following projects: Standard tests for welds, structural steel, welded rail joints, pressure vessels, welding wire, and fundamental research. The last is one of the most important activities of the bureau, and is conducted under the auspices of a committee on fundamental research. The activities of the committees on welded rail joints and structural steel have been practically completed. The committee on welding wire specifications is undertaking a statistical survey to determine if any changes need be made in the present specifications and also if any additional investigational work is needed. The committee on standard tests for welds is now working on the proposed standard tests and is considering modifications of the tensile and bend tests specimens. At the request of the National Bureau of Standards, the American Bureau of Welding formulated procedure specifications for use in connection with the preparation of aircraft joints to be tested. The bureau was officially represented on the sectional committee on safety code for the protection of the heads and eyes of industrial workers.

American Ceramic Society, Ross C. Purdy, general secretary, 2525 North High Street, Columbus, Ohio. Several committees on data, research, standards, and others are initiating various programs in connection with the formulation of standards relating to ceramics. Many of the standards adopted by the society have been prepared in cooperation with other organizations, notably, the American Society for Testing Materials, the American Standards Association, and the National Bureau of Standards. The society has formulated tentative recommended methods of test for the various uses of enamel, specifications for vitrified china, and standard classification of pottery and white ware, and electric porcelain. It also 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. The society is now initiating the movement for the establishment of standard masonry opening sizes.

American Chemical Society, Charles L. Parsons, secretary, Mills Building, Washington, D. C. The committee on standard apparatus of this society published a report setting forth recommendations for items of certain types of apparatus to be kept in stock by dealers and in laboratory store-rooms for ordinary laboratory work. Throughout this work the committee has had the cooperation of the committee on standardization of the Scientific Apparatus Makers of America. This committee is now cooperating with the Office of the Surgeon General of the Army in standardizing laboratory apparatus. The society's committee on analytical reagents presented a report containing recommended specifications for analytical reagents, including calcium carbonate, calcium carbonate low in alkalis, calcium chloride, cupric oxide wire form, cuprous chloride, lead acetate, magnesium sulphate, sodium metal, and zinc sulphate. The society is officially represented on sectional committees on safety code for mechanical refrigeration, classification of coals, and scientific and engineering symbols and abbreviations.

American College of Surgeons, Malcolm T. MacEachern, M. D., associate director and director of hospital activities, 40 East Erie Street, Chicago, Ill. Functioning as a professional and scientific body this association has taken an active part in the movement to bring about standardization among hospitals. In this work, which includes planning and construction of hospitals, equipment, organization, personnel, and procedure, the association is receiving helpful cooperation from local, State, and national medical, hospital, nursing, and allied organizations. The association has established a minimum standard of requirements for adoption by hospitals throughout the United States and Canada, and publishes annually a list of hospitals which have accepted the minimum requirements. The association has developed standards pertaining to clinical laboratories, X-ray departments, traumatic surgery, treatment of fractures, nursing, dietetics, clinical departments, out-patient work, social service, surgical dressings, and other features applying to hospitals.

American Concrete Institute, Harvey Whipple, secretary, 2970 West Grand Boulevard, Detroit, Mich. The institute's work in standardization is

carried on by numerous committees appointed to deal with various projects pertaining to concrete, and by representation on the following joint committees: Concrete culvert pipe, concrete and reinforced concrete, and methods of tests of road materials and cement. Standards and tentative standards adopted by the institute include those relating to Portland cement stucco, mixing and placing concrete in building, fabricating and setting reinforcing steel, concrete masonry units, concrete sewer manhole and catch basin block, cast stone, concrete staves, plain and reinforced concrete sewer pipe, drain tile, concrete pavements, concrete sidewalks, concrete floors, methods for the measurement of concrete work, monolithic concrete sewers and recommended rules for sewer design, and purchase specifications for concrete aggregates. In the last year committees presented reports covering the following subjects which were discussed at the institute's annual convention: Specifications for concrete work on ordinary buildings; Portland cement stucco finishes; disintegration of concrete; specifications for supplying, fabricating, and setting reinforced steel; specifications for ready-mixed concrete; recommended practice for the manufacture of concrete block and concrete building tile; coloration of concrete; construction specification for concrete work on the small job; and recommended practices in the uses of cast stone. The committee on reinforced concrete building design and specifications has submitted a report embodying a building code for reinforced-concrete building design and specifications which has been approved by the institute. This organization is officially represented on the sectional committees on specifications for Portland cement, fire tests of building construction and materials, methods of testing road and paving materials.

American Concrete Pipe Association, M. W. Loving, secretary, 33 West Grand Avenue, Chicago, Ill. This association has adopted standard specifications for plain concrete pipe, reinforced concrete pipe for culverts, sewers, and drain tile. In the development of these and other specifications, the association cooperated with the American Society for Testing Materials for plain concrete pipe and drain tile. It also cooperated with the Federal Specifications Board and the Port-

land Cement Association in the formulation of the Federal specification for plain or unreinforced concrete pipe. During the past year, the specification committee of this association and a committee of the American Society for Testing Materials prepared a new specification for reinforced concrete pipe which was adopted as a tentative standard at the 1930 annual convention of the American Society for Testing Materials. The association is represented on the Joint Concrete Culvert Pipe Committee, and took an active part in the preparation of the second report issued by the committee relating to standard specifications for reinforced concrete culvert pipe.

American Construction Council, Dwight L. Hoopingarner, executive, 28 West Forty-fourth Street, New York, N. Y. This council is concerned with permanency of building construction in relation to hazards of life and investment, uniform practices in building financing, community building standards, and methods of securing quality building materials. The council is still actively engaged in a survey of plans and methods for securing adequate housing at a fair cost in industrial communities and centers. The council is also 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 development of standards for city planning codes of practice, ordinance requirements, and uniform laws.

American Corn Millers Federation, L. H. Dieckman, secretary, Floyd and Bladen Streets, Louisville, Ky. One of the chief functions of this organization is the formulation of standards and specifications for cream meal. Several committees of the federation are actively cooperating with the Association of American Feed Control Officials and the United States Department of Agriculture in the establishment of definitions and standards for feeds made exclusively from corn. The federation has adopted a symbol whereby it licenses all millers who will agree to conform to the requirements set forth in the specifications for cream meal.

American Dental Trade Association, George A. Lilly, managing director, 839 Seventeenth Street, NW., Washington, D. C. Simplification constitutes an important activity of this association. Through this movement

it has formulated and adopted certain standards with respect to material and equipment used in the dental industry. This association initiated the movement which resulted in the simplified practice recommendation for hypodermic needles. Additional work in standardization and simplification is now being carried on by the association in connection with numerous other items used in the dental trade. At the present time, it is actively cooperating with the division of simplified practice in the elimination of excess sizes and varieties of abrasive wheels for mounted carborundum points, grinding wheels for engine mandrels, and lathes.

American Drop Forging Institute, Paul A. Androus, secretary, 405 First Trust and Deposit Building, Syracuse, N. Y. Among the stated objects of this organization is the standardization of designs and contract forms used in the industry, and formulation of specifications for materials and recommendations concerning good practice in manufacturing processes. The institute served as joint sponsor with the National Safety Council for the sectional committee on safety code for forging and hot-metal stamping.

American Drug Manufacturers Association, Carson P. Frailey, secretary, Albee Building, Washington, D. C. The association's committee on catalogue simplification has already completed the standardization of names and formulas for 151 elixirs, 52 sirups, and 171 simple tablets. The scientific section of this association is cooperating with the United States Pharmacopoeial and National Formulary revision committees in developing improved standards and methods for pharmaceuticals appearing in these official publications. Three subcommittees of the scientific section are engaged in work dealing with standards, assay methods, and tests. A committee of this association acting jointly with a committee of the American Pharmaceutical Manufacturers' Association cooperated with the Food and Drug Administration of the United States Department of Agriculture in the development of standardized analytical procedures and reasonable limits of tolerance for various pharmaceutical products.

American Dry Milk Institute (Inc.), Roud McCann, director, 221 North LaSalle Street, Chicago, Ill. The standards committee of this institute, ap-

pointed by the chairman of the board of directors, is developing methods of analysis for dry skim milk subject to the approval of the board and membership. In cooperation with the Bureau of Agricultural Economics and the Bureau of Dairy Industry of the United States Department of Agriculture and through the work of its own laboratory, as well as commercial laboratories, the standards committee formulated grades of dry skim milk and standard methods of analysis for the determination of moisture, butter fat, solubility, titratable acidity, and bacteria count in dry skim milk which have been approved and adopted by the institute. The committee is now engaged in keeping present methods and grades up to date and in conducting further research for the improvement of these grades and methods of analysis.

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 30 are concerned with the formulation or revision of standards and specifications. Committees of the power division have worked up a list of details to be included in all power contracts, to assist in the preparation of new or revised contracts. They have also developed specifications for catenary overhead construction and materials therefor, and have worked on specifications for the direct suspension type of overhead construction. In cooperation with other interested organizations, committees of the power division have developed a design for a new large size trolley wire. This is expected to satisfy the requirements of certain classes of trolley wire users, and when taken in connection with the existing series of smaller standard design wire, will provide a single set of trolley wire designs that will be accepted and followed by all users. These committees have also worked on the standardization of lightning-protection methods and practices. In the purchases and stores division work has been done on the following subjects: Unit piling in storerooms, and the allied subject of developing standard size packages of material; standardization of pricing methods and records to prevent losses in the purchases and stores departments; standardization and simplification of stock; and mate-

rial and supplies control as a step toward preventing waste through surplus and obsolete material. In the rolling stock division the following subjects have been studied: Development of new sizes of axles for use in the new heavier types of electrically-propelled vehicles recently placed in service by both steam railroads and electric railways; standardization of various practices and equipment used in the maintenance and operation of motor coaches; standardization in lighting practice of cars, shops, yards, and office buildings; and development of limits of wear for various parts of car equipment to prevent excessive maintenance costs and to improve the riding qualities of the cars. Committees of the way and structures division have been active in the development of specifications for standard track switches and other kinds of special track work; standard wood preservation methods and practices and materials therefor; the preparation of specifications for welding rods used in arc welding and in the preparation of arc welding rules for the instruction of electric railway users of that process; the preparation of an outline to show the factors which should be considered in the construction of bus garages for the sake of obtaining economy and convenience; the preparation of standard designations for association standard section rails, which will facilitate ordering supplies and keeping records; and the designing of a track gage which can be used for gaging track in service under all circumstances of track construction. The heavy electric traction committee has continued working toward a revision of the recommendations covering clearances for current collection devices to bring them into conformity with the latest practice on electrified railroads. In addition, a special committee of each of the divisions has reviewed existing sections of the American Electric Railway Engineering Association Manual, to assure that they are completely up to date. The new 1929 edition of this Engineering Manual has been issued by the association to supersede the old 1926 edition. In the field of standardization, this association cooperates with many organizations, of which the following may be mentioned: American Railway Engineering Association, American Society for Municipal Improvements, American Welding Society, National Association of Purchasing Agents, National Electric Light Association, Na-

tional Electrical Manufacturers Association, National Fire Protection Association, National Safety Council, Power Transmission Association, Society of Automotive Engineers, and the United States Department of Commerce. It has maintained for several years a research associate at the National Bureau of Standards investigating the relative advantages and efficiencies of new types of drives for street cars. 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. A number of standards have been submitted by this association to the American Standards Association and have been approved by that body. It is sponsor or joint sponsor for 13 sectional committees, 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 joint plates for 7 and 9 inch girder-grooved and girder-guard rails; designs for 7-inch, 80-pound, 91-pound, and 102-pound plain girder rail for use in paved streets; and special track-work material. At the present time the association has representatives on 40 American Standards Association sectional committees.

American Electrochemical Society, Colin G. Fink, secretary, Columbia University, New York, N. Y. The society's work in standardization is conducted largely by committees appointed to cooperate with committees of other organizations. The society's radio-battery committee cooperated with the National Electrical Manufacturers' Association and the National Bureau of Standards in the formulation of standard tests for dry cells used in radio receiving sets. Another committee collaborated in the establishment of the simplified practice recommendation for malleable foundry refractories. The corrosion committee is still continuing work with a similar committee of the American Society for Testing Materials in determining the best procedure for ascertaining the resistance to corrosion of various metals and alloys. The electrodeposition division of the society is still conducting investigations leading toward standardization of specifications for the electrodeposition of copper, chromium, and nickel.

American Electro-Platers Society, H. A. Gilbertson, secretary, 434 South

Wabash Avenue, Chicago, Ill. The society cooperates with the American Society for Testing Materials in research work on the protective value of chromium plating which, when completed, will serve as a basis for the formulation of specifications. It is officially represented on the sectional committee on specifications for zinc coating of iron and steel.

American Face Brick Association, George S. Eaton, secretary-treasurer, 130 North Wells Street, Chicago, Ill. The standardization activities of this association are confined principally to those relating to dimensions of face brick. Acting as joint sponsor with the Common Brick Manufacturers Association of America, this association cooperated in the establishment of standard sizes for face and common brick which are set forth in the simplified practice recommendation relating to these commodities. The association maintains a research associate at the National Bureau of Standards investigating the best methods of using face brick.

American Foundrymen's Association (Inc.), C. E. Hoyt, executive secretary; R. E. Kennedy, technical secretary, 222 West Adams Street, Chicago, Ill. Much of the work of this association in standardizing methods and materials is conducted by means of joint-committee sponsorship or by cooperating with such organizations as the American Society for Testing Materials and the American Standards Association. The society has sponsored two committees, the joint committee on pattern equipment standards, which formulated standards for pattern and core box color markings and for pattern plate lugs and vibrators, and the joint committee on foundry refractories, which prepared standards for shapes and sizes of refractories for malleable furnaces. The committee on molding-sand research has developed standard methods of testing and grading foundry sands which have been approved by the association. These have been tentatively adopted. Cooperating with the National Founders' Association, this organization developed a foundry safety and sanitary code which was approved as a tentative American standard by the American Standards Association. It is joint sponsor with the American Ceramic Society for the joint committee on standardizing tests for foundry refractories, and with the American Society of Mechanical Engineers for a joint committee to con-

sider standardization of foundry equipment. The society cooperated in the establishment of the simplified practice recommendation relating to standard shapes and sizes for malleable foundry refractories, and also in the formulation of the commercial standard for foundry patterns of wood. It maintains a research associate at the National Bureau of Standards investigating liquid shrinkage in metals. The association is joint sponsor for two sectional committees, as follows: Safety code for the protection of industrial workers in foundries (with the National Founders' Association); and outside dimensions of plumbago crucibles for nontilting furnaces in nonferrous foundry practice (with the Plumbago Crucible Association). It is also represented on nine additional sectional committees.

American Fruit and Vegetable Shippers Association, E. S. Briggs, manager-secretary, 1425 South Racine Avenue, Chicago, Ill. This organization has cooperated with all other interested bodies and groups in the establishment of standard trading rules and definitions of trade terms for the fresh fruit and vegetable industry. It has formulated and adopted a standard confirmation of sales form, also a standard form of brokers memorandum of sales to be used in cases where time does not permit the use of the form previously mentioned, a standard form of brokers' agency contract used to cover engagements between shippers and brokers, and a standard inspection form upon which to record the condition of commodities loaded in freight cars and the manner in which they are received at destination. Several committees are cooperating with the United States Department of Commerce and the Freight Container Bureau of the American Railway Association on standard containers used in the shipment of commodities and with the United States Department of Agriculture on standards and grades for foods. To insure better transportation of goods, this association is using its influence to bring about closer cooperation between growers, shippers, dealers, railroads, container manufacturers, and governmental agencies to project the plan of standardizing containers, using better material, and perfecting loading, stowing, and bracing. This association is urging governmental departments to make an economic survey of all the larger markets relating to fresh fruits and vegetables, so that the normal de-

mands and requirements of those markets may be known to all, which should aid materially in better and more even distribution. It is also encouraging the making of a study of ways and means of using the surpluses of fruits and vegetables in by-products.

American Gas Association (Inc.), Alexander Forward, managing director, 420 Lexington Avenue, New York, N. Y. This organization conducts many research activities relating to problems affecting the production, distribution, sale, and utilization of gas at its own laboratories and those of the United States Bureau of Mines, the American Institute of Baking, Case School of Applied Science, Universities of Michigan, Pennsylvania, and Rutgers. Research associates are maintained at the National Bureau of Standards carrying on research work in connection with gas combustion and pipe corrosion and protective coatings. Manufacturers of appliances which have been approved by the association's laboratory as complying with its safety and performance requirements are permitted to attach to the appliance the official approval seal of the association. Such requirements are now effective for gas ranges, water heaters, space heaters, central house-heating appliances, hot plates and laundry stoves, incinerators, clothes dryers and flexible tubing, as well as house piping and appliance installation. Work on the utilization of mixed gases is now nearing completion. The association is carrying on fundamental research in the standardization of orifice meters for large volume high-pressure gas transmission lines and is developing basic formulas for calculating the capacity under varying conditions of long-distance high-pressure lines. The association has cooperated in the formulation of the commercial standard relating to standard weight malleable iron or steel screwed unions. The association is sponsor for the sectional committee on gas appliances, and joint sponsor for the following committees functioning under the procedure of the American Standards Association: Specifications for cast-iron pipe and special castings, pipe threads, and gas safety code. The association is actively represented on certain of the appropriate projects of the American Society for Testing Materials, as well as with other national organizations in standardization matters.

American Gear Manufacturers Association, T. W. Owens, secretary, 3608 Euclid Avenue, Cleveland, Ohio.

In carrying forward its work on standardization, this association cooperates with other organizations through representation on sectional committees of the American Standards Association. It is joint sponsor for two sectional committees on standardization of gears (with the American Society of Mechanical Engineers and the Society of Automotive Engineers), and on transmission chains and sprockets (with the American Society of Mechanical Engineers), and is also officially represented on the sectional committee on standardization of shafting.

American Grocery Specialty Manufacturers' Association, H. F. Thunhorst, secretary, 53 Park Place, New York, N. Y. The technical committee on soaps of this association cooperated with a similar committee of the Federal Specifications Board in the formulation of Federal specifications relating to soaps. These specifications are generally used by the various agencies and units of the Federal Government. The association is now conducting work on standard invoice forms to be used by its members.

American Hardware Manufacturers Association, Charles F. Rockwell, secretary, 342 Madison Avenue, New York, N. Y. This association's work in simplification and standardization is carried on by committees cooperating with the American Standards Association and the National Bureau of Standards. In cooperation with the National Hardware Association of the United States, it assisted in the establishment of commercial sizes for steel sheets which are set forth in the simplified practice recommendation relating to this commodity. The association is officially represented on sectional committees dealing with the following projects: Standardization and unification of screw threads; bolt, nut, and rivet proportions; plain and lock washers; and wire and sheet metal gages.

American Home Economics Association, Alice L. Edwards, executive secretary, Mills Building, Washington, D. C. Under the auspices of the American Standards Association, this organization has initiated standardization projects for refrigerators, bed sheeting, and bed blankets. The textile section of the association has supplemented its previous research on silk by studies on the effect of light, ultra-violet light, air, and perspiration on the physical and chemical properties of weighted and unweighted silk. Through committees in 22 States and

the District of Columbia, the association is actively promoting the education of the consumer in understanding, appreciating, and using standards and specifications in connection with the purchasing of personal and household goods, and has published household purchasing suggestions for club programs. This association cooperated in the establishment of commercial standards for dress patterns, boys' blouses, waists, shirts, and junior shirts, men's pajamas, and wall paper. It also took an active part in the formulation of simplified practice recommendations for various commodities.

The association has formally transmitted to the American Standards Association a resolution offering to cooperate in an attempt to secure more labels for consumer's goods which will give accurate information to the over-the-counter buyer. It has requested the A. S. A. to initiate an investigation of methods of safeguarding the interests of ultimate consumers when labels in terms of specifications are used.

American Hospital Association, W. P. Morrill, M. D., chairman, committee on simplification and standardization, Maine General Hospital, Portland, Me. Specifications prepared by this association for use by hospitals in the purchase of supplies and foodstuffs include those for meats, canned fruits, vegetables, soaps, and cleaning compounds. The association has also adopted and published 57 Federal specifications promulgated by the Federal Specifications Board relating to commodities most commonly used and purchased by hospitals. Through the work of the committee on simplification and standardization, this association cooperated in the establishment of the commercial standard for clinical thermometers. It initiated the movement for the simplification of grades and sizes of hospital beds, chinaware, cotton textiles, and hospital plumbing fixtures, which resulted in the formulation of simplified practice recommendations covering these items. The association is officially represented on four sectional committees as follows: Safety code for walk-way surfaces; standardization of plumbing equipment; standards and specifications for refrigerators; and standards and specifications for sheets and sheeting.

American Institute of Architects, Structural Service Department, LeRoy E. Kern, 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 30 building materials and appliances. The institute has issued the following standard contract forms, with the object of improving contract practice in the building industry: Agreement between contractor and owner for construction of buildings, general conditions of the contract for the construction of buildings, subcontract and bond forms, and acceptance of subcontractor's proposal. These forms are now in the fourth edition. It 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. The institute represents the architectural profession on a large number of committees of organizations dealing with the standardization of building materials and appliances, among which may be mentioned the National Committee on Wood Utilization, Building Code Committee of the United States Department of Commerce, division of simplified practice of the National Bureau of Standards, National Fire Protection Association, the American Society for Testing Materials, and the American Standards Association. It is joint sponsor for six sectional committees, as follows: Elevators (with the American Institute of Electrical Engineers and the American Society of Mechanical Engineers); safety code for elevators and escalators (with the American Society of Mechanical Engineers and the National Bureau of Standards); safety code for lighting of school buildings (with the Illuminating Engineering Society); symbols for electrical equipment of buildings (with the American Institute of Electrical Engineers and the Association of Electragists, International); safety code for walk-way surfaces (with the National Safety Council); specifications for plastering (with the American Society for Testing Materials); and safety code for construction work (with the National Safety Council).

American Institute of Baking, Henry Stude, president, 1135 Fullerton Avenue, Chicago, Ill. The institute is conducted by the American Bakers Association for scientific research and education. One of its chief

functions is to standardize the form and method for the estimate of quality of baked goods and to encourage the "scoring" of bakery products. The institute has adopted standards for dough mixers covering capacity of bowl, heights, etc., which have been formulated jointly by the Bakery Equipment Manufacturers' Association and the American Society of Bakery Engineers. It has also adopted standard definitions of certain bakery products promulgated by the United States Department of Agriculture. Through its laboratories and service bureaus, the institute is teaching the baker to produce a product of higher standards of value.

American Institute of Chemical Engineers, Frederic J. LeMaistre, executive secretary, Bellevue Court Building, Philadelphia, Pa. Committees of the institute are actively engaged in standardization work in co-operation with similar committees of other interested organizations. The committee on evaporator test code cooperated with the American Society of Mechanical Engineers in the development of the code which has been published by the latter organization. Another committee cooperated with the sectional committee on the code for the identification of piping systems which has been approved by the American Standards Association. Similar committees are conducting work in making studies of smoke prevention and the various uses of alcohol. The society is also cooperating with the National Safety Council and with the Ordnance Department of the War Department, and is represented on the sectional committee for the development of a code for pressure and vacuum gages.

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, each section dealing with standards for a specific subject. Thirty-seven sections have been completed, as follows: No. 1, general principles upon which temperature limits are based in the rating of electrical machinery; No. 4, measurement of test voltage in dielectric tests; No. 5, direct-current generators and motors and direct-current commutator machines in general; No. 7, alternators, synchronous motors, and synchronous machines in general; No. 8, synchronous converters; No. 9, induction motors

and induction machines in general; No. 10, direct-current and alternating-current fractional horsepower motors; No. 11, railway motors; No. 12, constant-current transformers; No. 13, transformers, induction regulators and reactors; No. 14, instrument transformers; No. 15, industrial control apparatus; No. 16, railway control apparatus; No. 17f, mathematical symbols; No. 17g1, letter symbols for electrical quantities; No. 17g6, graphical symbols for telephone and telegraph use; No. 19, oil circuit-breakers; No. 20, air circuit-breakers; No. 22, disconnecting and horn-gap switches; No. 26, automatic stations; No. 30, wires and cables; No. 33, electrical measuring instruments; No. 34, telegraphy and telephony; No. 36, storage batteries; No. 37, illumination; No. 38, electric-arc welding apparatus; No. 39, electric resistance welding apparatus; No. 41, insulators; No. 42, symbols for electrical equipment of buildings; No. 45, recommended practice for electrical installations on shipboard (marine rules); No. 46, hard-drawn aluminum conductors; No. 60, specifications for tinned soft or annealed copper wire; No. 61, specifications for soft or annealed copper wire; No. 63, specifications for 30 per cent rubber insulation for wire and cable for general purposes; No. 69, specifications for cotton covered round copper magnet wire; No. 70, specifications for silk-covered round copper magnet wire; No. 71, specifications for enameled round copper magnet wire. Of these 37 standards, 19 have been approved as American Standards under American Standards Association procedure (Nos. 8, 11, 14, 15, 16, 17f, 17g1, 17g2, 36, 37, 41, 42, 46, 60, 61, 63, 69, 70, and 71). In cooperation with the Bureau of Foreign and Domestic Commerce, Spanish translations of the American Institute of Electrical Engineers standards Nos. 1, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 19, 22, 30, 33, 37 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 advisory committee. The institute 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; power-line insulators for voltages exceeding 750; power-line insulators for voltages not exceeding 750; 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 other organizations); code on protection against lightning (with the National Bureau of Standards). Committees of the institute are now at work on the following standardization topics: Lightning arresters, general principles upon which temperature limits are based in the rating of electrical machinery and apparatus, switchboards for power and light, rule for altitude correction capacitors and fuses. Recommendations on the operation of transformers have just been issued. Preliminary steps have been taken for the development of a series of electrical test codes. The institute has also 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, Philadelphia, Pa. Under the direction of the institute, the pharmacopœia committee prepared a third edition of the *Homeopathic Pharmacopœia of the United States* which was subsequently approved and published by the institute. The pharmacopœia contains a list of all drugs which have been accepted as standard for the preparation of homeopathic remedies.

American Institute of Mining and Metallurgical Engineers, H. Foster Bain, secretary, 29 West Thirty-ninth Street, New York, N. Y. The standardization work of this institute is conducted in cooperation with the American Standards Association, of which it is a member body, and is officially represented on the mining standardization correlating committee. The board of the institute has

adopted a report entitled "Danger from Oil and Gas Wells to Coal-Mining Operations and Draft of a Model Law for Use of the Legislature of any State." It is serving as sponsor for two sectional committees on methods for screen testing of ores and recommended practices for rock dusting of coal mines, and is also represented on 13 additional sectional committees dealing with safety codes, equipment, and recommended practices in mines.

American Institute of Refrigeration, Louis Baron, executive secretary, 570 Seventh Avenue, New York, N. Y. This institute includes in its membership several National and State associations interested in refrigeration. Its work in standardization is carried on by committees cooperating with committees of other organizations. The institute is officially represented on sectional committees dealing with the following subjects: Safety code for mechanical refrigeration, pipe flanges and fittings, standardization of dimensions and material of wrought iron and wrought steel pipe and tubing, standards and specifications for refrigerators, and scientific and engineering symbols and abbreviations. The institute is at present cooperating with other organizations in the formulation of standards for cast-iron flanged ammonia and screwed fittings, refrigerating piping, and pressure and vacuum gages.

American Institute of Steel Construction (Inc.), Charles F. Abbott, executive director, 200 Madison Avenue, New York, N. Y. This organization is interested in the adoption of its standard specifications covering uses of structural steel in building construction in State and municipal building codes. The institute's standards have already been accepted by 287 cities and 15 State bodies. The standard specifications adopted by the institute and published in its *Standard Handbook of Steel Construction* are as follows: Specification for the design, fabrication, and erection of structural steel for building; American Society for Testing Materials 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. The institute is continuing its cooperation with the American Welding Society in establishing standards of welding in bridge and

building construction. 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 a research associate at the National Bureau of Standards doing research work on fire tests on battle deck floor construction.

American Institute of Weights and Measures, W. E. Bullock, secretary, 33 Rector Street, New York, N. Y. This institute is not a standards-making body. Practically all of its work consists in the collection, classification, and dissemination of legislative and industrial records relating to weights and measures.

American Leather Belting Association, J. L. Nelson, secretary, 41 Park Row, New York, N. Y. Cooperating with the technical committee of the Federal Specifications Board, this association assisted in the preparation of the Federal specification for leather belting, which is being generally used by the various agencies of the Federal Government.

American Leather Chemists Association, H. C. Reed, secretary, 143 West Twentieth Street, New York, N. Y. Much of the work of this association in the formulation and adoption of methods of analysis for leathers is conducted by committees appointed by and under control of a council consisting of seven members, including the president, vice president, and secretary. The association has adopted the following official and provisional methods of analyses: Chrome tanning materials; vegetable tanned leathers; chrome tanned leathers; greases and oils, including hard greases, Moellons, and sulphenated (sulphated) oils; lactic acid; and vegetable materials containing tannin. It has also adopted the international method for analysis of vegetable materials containing tannin; determination of sugars in tanning materials; and official and provisional methods for sampling tanning materials.

American Marine Standards Committee (see Ch. VII, p. 272.)

American Medical Association, Chemical Laboratory, Paul Nicholas Leech, director, 535 North Dearborn Street, Chicago, Ill. The chief function of the chemical laboratory is to determine which medicinal preparations are to be included as standards in the book entitled "New and Non-official Remedies" published by the council on pharmacy and chemistry of the American Medical Association.

This publication is revised annually. In addition, the chemical laboratory conducts investigations of market specimens of various brands of the same substance, and does original work to aid the medical profession in obtaining a rational *materia medica*.

American Medical Association, Council on Pharmacy and Chemistry, W. A. Puckner, secretary, 535 North Dearborn Street, Chicago, Ill. The council publishes annually the "New and Nonofficial Remedies," in which are listed and described the articles which stand accepted by the council on January 1 of each year. The descriptions 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. New and revised drugs are included annually after the necessary tests have been made by the chemical laboratory of the association and approved as standards by the council.

American Mining Congress, J. F. Callbreath, secretary, Munsey Building, Washington, D. C. Through its national standardization division, composed of two branches—coal and metal—this organization has prepared and adopted the following standards, which have also been approved by the American Standards Association: Underground transportation in metal mines; mechanical loading in metal mines; underground power transmission and power equipment (coal); coal mine drainage; wire rope for mines; coal mine tracks, signals and switches; miscellaneous outside coal handling equipment; and ladders and stairs for mines. In addition, standards for fire-fighting equipment in metal mines; coal mine ventilation; the first revision on the above coal mine drainage standard, and methods of mine sampling; methods of recording underground geological data; methods of estimating ore reserves for low, medium, and high grade ore bodies, have been adopted. Committees of the standardization division are engaged in the following projects: Mechanical loading, 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. For promoting the use of standards, the committees of this organization have given wide circulation to a handbook containing all completed

recommendations. Extensive publicity is also given to the standardization movement through the medium of the organization's official publication, the *Mining Congress Journal*. It is the practice of the committees to make periodic resurveys of the field covered and hold conferences to promote the standardization movement in the industry. The American Mining Congress is a member body of the American Standards Association. It is sponsor or joint sponsor for 11 sectional committees, as follows: Drainage of coal mines, outside coal-handling equipment, wire rope for mines, ladders and stairs for mines; underground transportation in coal mines, underground transportation in metal mines, underground mechanical loading in metal mines, safety code for transportation in coal mines, fire-fighting equipment in metal mines (with National Fire Protection Association), coal mine locomotives (with the National Electrical Manufacturers' Association), and safety rules for installing and using electrical equipment in coal mines (with United States Bureau of Mines).

American Oil Burner Association (Inc.), Harry F. Tapp, executive secretary; W. C. Schoenfeldt, technical secretary, 342 Madison Avenue, New York, N. Y. This association has recently taken over the activities of the Oil Heating Institute. In its work in standardization this association has recommended, a model ordinance governing the construction and installation of oil-heating equipment and for the storage and use of oil fuels in connection therewith, for use by municipal authorities having jurisdiction over such installations. For the purpose of encouraging the use of the model ordinance, this organization publishes and issues a circular entitled "For Clean Cities—Oil Heat and Constructive Municipal Regulation." A technical research program, including the test of various types of oil burners in different boilers 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. This organization is officially represented on the sectional committees on methods of testing petroleum products and lubricants and standardization of speeds of machinery. It has adopted an advertising code, general trade practices, and standards of business conduct. The association cooperated in

the establishment of the commercial standard for domestic and industrial fuel oils.

American Oil Chemists' Society, J. C. P. Helm, secretary, 705 Tchoupitoulas Street, New Orleans, La. The standard methods of sampling and analysis of commercial fats and oils promulgated by the American Chemical Society have been indorsed and adopted by this society. Intimately associated with the cottonseed industry, it works in harmony with the National Cottonseed Products Association, and thus certifies to the official methods of chemical analysis of cottonseed, cottonseed hulls, crude cottonseed oilcake, meal, meats, and associated oils.

American Optometric Association (Inc.), department of research, Edwin H. Silver, M. D., associate director, 1410 G Street, NW., Washington, D. C. Modern traffic conditions have emphasized the necessity of this association's work on vision of motor drivers. In cooperation with the National Research Council, it is endeavoring to ascertain the limits of safety vision. The preparation of standards of visual acuity for motor-vehicle operators is one of its chief contributions to traffic regulation.

American Paint and Varnish Manufacturers Association (Inc.), G. V. Horgan, general manager, 18 East Forty-first Street, New York, N. Y. Superfluous sizes of containers and color varieties in paints and varnishes have been eliminated by a joint committee on simplification which is composed of representatives of this association and the National Paint, Oil, and Varnish Association.

American Paper and Pulp Association, Jesse H. Neal, general manager, 18 East Fifty-first Street, New York, N. Y. This association cooperated in the establishment of the simplified practice recommendation for standard sizes and grades of paper. Its advisory committees collaborate with the National Bureau of Standards and the Forest Products Laboratory of the United States Department of Agriculture on technical matters dealing with the manufacture of pulp and paper. The association is now undertaking a simplification of paper samples to eliminate many forms and sizes which are now used, making it exceedingly difficult for paper dealers, printers, and paper users to maintain an adequate file. The association is officially represented on sectional committees on safety codes for conveyors and con-

veying machinery and paper and pulp mills.

American Petroleum Institute, W. R. Boyd, jr., executive vice president, 250 Park Avenue, New York, N. Y. On recommendation of the general committee on refinery technology, this institute adopted 21 standards of the American Society for Testing Materials on methods of test for petroleum products. Through its division of production (formerly division of standardization) the institute has adopted the following standards and specifications: Transmission standards—dimensions on shafting, keys, and chains; miscellaneous rotary standards—methods of measurement on sheaves, drilling hooks, spiders, and overshot bowls; rotary drilling tool joints—dimensions of threaded rotary taper tool joints and fishtail bits, drill collars, driving stems; rotary line shafts—shafting, keys, keyways; cable drilling tools—dimensions of threaded taper joints for cable tools; rigs and derricks—principal dimensions of steel and wood derricks and standard rig parts; belting—covering leather, cotton fabric, woven hair and cotton, balata and rubber belting; wire rope—physical tests and sections on attaching sockets and galvanized-wire guy strand; manila cordage—size and methods of test; oil field boilers—size and fittings for locomotive type oil field boilers; electric induction motor performance data—method of reporting performance data; miscellaneous pumping equipment standards—specifications on polished rods, pull rods, countershafts for belted pumping units and reduction gears; specifications on dimensional standards on cold-drawn and machined-working barrels and couplings, and on working barrel pump parts; cages, balls and seats, plungers, cup rings, and cups; casing, drill pipe, and tubing and line pipe—chemical, physical, and dimensional standards; rig irons—dimensional standards on crank shafts, flanges, sand reels, pulleys, boxes; internal-combustion engines and clutches—exhaust and intake connections and method of rating engines; working barrels; sucker rods—complete joint dimensions; riveted tanks—chemical, physical, and dimensional properties, and fabrication and erection specifications for riveted steel oil-storage tanks (capacities 240 to 134,000 barrels); bolted tanks—stave sizes and bolt spacing (capacities 100 to 10,000 barrels). The institute has also adopted codes on recom-

mended field practice for the proper care of boilers, cable-drilling tools, rigs, and derricks, oil country tubular goods, and rig irons. Another code has recently been adopted on standard procedure for measuring, sampling, and testing crude oil which includes measuring field storage and production tanks and the formulation of standard gage tables used to compute the quantity of oil contained therein. 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 upon certifying that the material so marked complies with all of the conditions and standards contained in the official publications of the institute relating thereto. The institute cooperated with the division of trade standards of the National Bureau of Standards in the establishment of commercial standards for domestic and industrial fuel oils and for steel and wrought-iron pipe nipples. The institute maintains representation 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. Ten committees of this association are engaged in standardization of pharmaceuticals and medicinal preparations. The fifth edition of the National Formulary, extra to the United States Pharmacopœia, was prepared by the committee on National Formulary and published by the association in 1926. Another committee has been appointed to prepare the sixth edition. The committee on physiological testing concerns itself with the development of processes for the testing of those drugs and preparations which do not lend themselves to other methods of standardization. The committee on international pharmaceutical nomenclature cooperates with foreign associations in bringing about uniformity as far as possible. In cooperation with committees from the American Association of Colleges of Pharmacy and the National Association of Boards of Pharmacy, the committee on pharmaceutical syllabus is preparing a minimum course to be taught in the various colleges of pharmacy. The committee on unofficial standards is engaged in the formulation of standards for such drugs and chemical products for which standards are not otherwise provided.

The committee on recipe book has completed the first edition of this work, which is intended to serve as a supplement to the United States Pharmacopœia and the National Formulary. The committee on horticultural nomenclature represents the association in cooperating with other scientific bodies in this important endeavor. The committee on weights and measures has for its principal activity the extension of the use of the metric system in pharmacy. Other committees are engaged in standardizing requirements for pharmaceuticals as far as possible. Another committee is investigating the light-protecting properties of various colored glass containers and is determining the amount of protection afforded or deterioration produced by light from the ultra-violet and infrared regions of the spectrum. It is expected that the work of this committee will result in the preparation of 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.

American Pharmaceutical Manufacturers' Association. R. M. Cain, chairman, committee on standardization and simplification, care of Swan-Myers Co., Indianapolis, Ind. In cooperation with the American Drug Manufacturers Association, this organization has prepared and adopted standard formulas for ampoules, biological products, glandular products, tablets, pills, elixers, and sirups. Standards have also been adopted for containers for standard size listings for bacterial vaccines (5 and 20 cc); ampoule solutions (1 and 2 cc), in boxes of 6, 12 and 100; ampoules (5, 10, 20, 50, and 100 cc.), in boxes of 6, 25, and 100 ampoules; glandular products, tablets, and capsules, in packages of 100 and 500; ophthalmic and nasal ointments, in packages of 12 tubes only; tablets and filled capsules, in bottles of 100 and 1,000; all liquids including elixers, sirups, fluid extracts, tinctures, emulsions, etc., in pints and gallons; ointments in 1 and 5 pound jars; and effervescing salts, in 4 and 16-ounce glass containers. This association has also formulated standard-size pharmaceutical catalogues and uniform arrangement for the listing of various products. A committee of this association acting jointly with a com-

mittee from the American Drug Manufacturers Association cooperated with representatives of the Food and Drug Administration of the United States Department of Agriculture in the development of standardized analytical procedures and reasonable limits of tolerance for various pharmaceutical products.

American Public Health Association, Homer N. Calver, executive secretary, 370 Seventh Avenue, New York, N. Y. The standardization programs of this association include standard record forms for health departments, standard forms for the tabulation of vital statistics, and similar matters. In cooperation with the American Water Works Association it has formulated standard methods for the examination of water and sewage, the sixth edition of which was issued in 1925. It has also revised its standard methods of milk analysis, the fifth edition of which was issued in 1927. The association is officially represented on the sectional committee on code for the lighting of school buildings. A standing committee on research and standards is studying other standardization problems.

American Railway Association, H. J. Forster, secretary, 30 Vesey Street, New York, N. Y. The activities of this association are conducted under the following eight divisions, several of which are subdivided into sections: (1) Operating, which includes freight station, medical and surgical, protective, safety, and telegraph and telephone sections; (2) transportation; (3) traffic; (4) engineering, under which function the construction and maintenance, electrical, and signal sections; (5) mechanical, which includes the equipment painting section; (6) purchases and stores; (7) freight claim; and (8) motor transport. Five of these divisions are concerned with standardization and simplification 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 A. R. A.; also the signal, and telegraph and telephone sections.)

American Railway Association, Freight Claim Division, Lewis Pilcher, secretary, 59 East Van Buren Street, Chicago, Ill. This organization was formed in 1892 by a consolidation of several territorial railroad claim organizations. Its duties are to consider a report upon methods of settlement of freight claims of shippers, consignees, and carriers, and to study the causes of freight loss and damage and develop preventive measures in connection therewith, including encouragement of standard and uniform practices, the use of uniform blanks, etc. The committee on freight claim prevention is now actively engaged in formulating a code of standard recommended practices to be followed by carriers in the prosecution of their loss and damage prevention work particularly from an interline standpoint. In cooperation with other organizations, committees of this division are interested in the development of appliances to facilitate the safe and expeditious movement of freight. In the current edition of its Rule Book, the division has published a list of standard forms which are recommended for use in the presentation and prosecution of claims arising in the transportation of goods.

American Railway Association, Freight Container Bureau, Edward Dahill, chief engineer, 30 Vesey Street, New York, N. Y. This bureau, one of the agencies of the American Railway Association, was organized for the specific purpose of developing standard containers for the many different commodities which are moved by freight, as well as to give constructive assistance to shippers on questions involving the packing and construction of containers. In formulating recommended methods for the packing of the various commodities and construction of standard containers, surveys are conducted by engineers who visit the manufacturing plants, consignees' receiving rooms, railroad stations, and transfers to examine containers. Conferences are held with committees of organizations interested in shipping containers and with railroad and steamship officials. When necessary, laboratory and shipping tests are made of containers to determine their

practicability and economy in the shipment of commodities. As a result of these surveys tentative recommendations are prepared and circulated among the industry for comments and criticisms, after which the final recommendations are prepared and circulated among the industry in printed pamphlet form. These recommendations are not compulsory, their acceptance being at the discretion of the shippers. The bureau has prepared and published a series of illustrated circulars and bulletins covering recommended standard methods of packing and specifications for the construction of the containers for new furniture, divided as to class furniture; boots and shoes; eggs in the shell; shelled and frozen eggs; pottery; glassware; oil, cast-iron, gas, and electric cook stoves; parlor heaters; warm-air heaters; household and commercial refrigerators; commercial store fixtures; citrus fruits; grapes; and other fresh fruits and vegetables. It has also issued general bulletins covering metal cans for liquids; construction principles of wooden crates; and wooden boxes. The bureau has now under way the standardization of containers for soda fountains; sanitary ware and fixtures; stone markers and monuments; crates and skids for machinery; methods of loading and bracing sewer pipe, drain tile, and allied clay products; skids, cradles, and crates for motor boats; and crates and methods of loading for airplane and airplane parts.

American Railway Association, Mechanical Division, V. R. Hawthorne, secretary, 59 East Van Buren Street, Chicago, Ill. The formulation and adoption of standards of recommended practices for use in railway industry constitute important activities of this division. Practically all of the work is handled by committees in cooperation with similar committees of other interested organizations. All of the division's standards are incorporated in its manual which is divided into the following 12 sections: Specifications for materials; gages and testing devices; car construction; trucks and truck details; brakes and brake equipment; locomotive wheels, tires, and miscellaneous locomotive standards; safety appliances for cars and locomotives; train lighting, headlights and classification lamps; rules for fuel economy on locomotives; inspection and testing of locomotive boilers and rules and instructions for inspection and testing of steam locomotives and tenders; specifications

for tank cars; and miscellaneous standards and recommended practices. The division has also issued a supplement to the manual containing drawings for standard cars and trucks which have been adopted by the association as recommended practices. During the past year, committees of the division have revised numerous existing standards and drawings appearing in the manual and supplement, and have adopted new ones, as follows: Normalized and tempered carbon steel forgings; high chrome steel rivet material and rivets, tubing, castings and tank plates for nitric acid tank cars; dust guards; and new car oil. The division has also issued in separate pamphlet form codes of rules governing the condition of, and repairs to, freight and passenger cars for the interchange of traffic; and the rules governing the loading of lumber, logs, stone, etc.; and loading and carrying structural materials, plates, rails, girders, etc. It has also issued a set of standard rules with respect to the maintenance of air brake and air signal equipment on locomotives and cars. The division has also prepared a manual of recommended practice relating to wheels and axles, for the guidance of wheel and car inspectors, mechanics in the shops, supervisory officers, and others who are responsible for this phase of the work. The division's specifications for safety appliances for cars and locomotives are in conformity with those of the Interstate Commerce Commission. The division is officially represented on five sectional committees on standardization and unification of screw threads; pipe flanges and fittings; bolt, nut, and rivet proportions; standardization of dimensions and material of wrought-iron and wrought-steel pipe and tubing; and specifications for rolled threads for screw shells of electric sockets and lamp bases.

American Railway Association, Operating Division, J. C. Caviston, secretary, 30 Vesey Street, New York, N. Y. This division publishes and keeps up to date the Standard Code of the American Railway Association relating to train, block signal, and interlocking rules, as well as standard definitions for the various terms used in railway operation. The division has also issued specifications for track torpedoes; 5-minute red fuses; standard bunting signaling flags; lanterns for use on crossing gates and by highway crossing watchmen and gatemen; and standard drawings relating to

approach warning and stop signs, and painting for highway gate arms.

American Railway Association, Purchases and Stores Division, W. J. Farrell, secretary, 30 Vesey Street, New York, N. Y. The standardization activities of this division are conducted by subject committees and include the adoption and revision of recommended standards with the object of creating the highest efficiency and economy in the purchasing, handling, and distribution of materials and supplies. Standards covering the following subjects have already been adopted by the division: Rules for railroad stores department operation, including the standard stock book; rules for railroad purchasing department operation; material classification; classification of scrap; reclamation practices; type of store buildings and facilities; and method of unit piling materials. In addition, the division conducted a simplification of stores stock program which resulted in a reduction in the number of items carried in stock and in the elimination of special material involving higher prices. A committee of this division has completed a report embodying recommendations regarding standard types of buildings for storing stock and equipment, paints and oils, explosives, garages, lumber sheds, and oxygen and acetylene. Another committee has submitted recommendations for the standardization of pipe fittings and valves, manhole and handhole gaskets, padlocks, and railway electrification materials. At the request of the American Electric Railway Association, this division is cooperating in the formulation of standard packages.

American Railway Association, Signal Section, R. H. C. Balliet, secretary, 30 Vesey Street, New York, N. Y. A portion of the standardization work of this section is carried on in cooperation with technical societies and trade associations and by official representation on committees of the American Standards Association, American Committee on Inductive Coordination, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, American Wood Preservers' Association, and the Bureau of Mines of the United States Department of Commerce. The section revises and keeps up to date the drawings and specifications contained in its Manual of Recommended Practice relating to the design, construction, maintenance, and operation of railway signaling devices. This sec-

tion officially approved the adoption, and in certain cases revisions of the following standards and recommended practices: Application of various types of track circuit bonds; aerial braided cable; channel pin, universal switch circuit controllers, alternating-current power transfer relay, maintaining and testing motor semaphore signals, technical terms used in signaling maintaining and testing light signals, fuses, maintaining and operating rectifiers, switch indicators, mechanical interlocking machine (S. & F. locking, style "A" locking), electric interlocking machine, gray-iron castings, malleable-iron castings, wrought-iron bars, alternating current relay, maintaining and testing interlocking plants, track transformer, air cooled, single phase, and electromechanical interlocking machine. This section has also officially approved the following drawings: Details of tower lead outs (mountings for cranks or deflection bars), cast-iron washer, tags for marking wires, pattern and mold for arbitration test bar, and tension test specimen. This section conducts an educational campaign among signal department employees through the medium of textbooks regarding all phases of American railway signaling principles and practices.

American Railway Association, Telegraph and Telephone Section, W. A. Fairbanks, secretary, 30 Vesey Street, New York, N. Y. Numerous standing committees are actively engaged in carrying forward the standardization work of this section which functions as a part of the operating division of the American Railway Association. It has published a loose-leaf manual and pocket handbook for use by supervisory engineering and field forces. These publications contain 192 recommended practices for the advancement of the efficiency of the telegraph and telephone departments of the railroad service. Over 125 subjects, including the following important projects, are now being considered by committees of this section: Communication transmission, radio and wire carrier systems, electrical protection, message traffic, economics, inductive interference, outside plant, inside plant, protection against electrolysis, accident and fire prevention and education and training of employees. This section is represented on 13 sectional committees on specifications for wood poles, overhead line material, line insulators for voltages not exceeding 750, national electrical safety

code, radio, unification of methods of designating thicknesses of wire and metal sheets and plates, manhole frames and covers, lightning protection, abbreviations and symbols, electrical definitions, specifications for dry cells and batteries, specifications for zinc coating of iron and steel, and survey of current practices for graphic presentation.

American Railway Car Institute, W. C. Tabbert, secretary-treasurer, 61 Broadway, New York, N. Y. Freight-car standardization is one of the functions of this society. This work is carried on in conjunction with committees of the American Railway Association. Other standardization work is done by sectional committees of the American Standards Association on which this institute is actively represented. The institute is also co-operating with the Electric Railway Presidents' Conference Committee in the design and adoption of new electric railway car standards.

American Railway Engineering Association, E. H. Fritch, secretary, 59 East Van Buren Street, Chicago, Ill. The manual of this association covers a wide variety of subjects related to railway construction and maintenance, including standards and specifications for masonry, water, sewers, sanitation, wood preservation, and wood bridges, and trestles. This association also functions as the construction and maintenance section of the engineering division of the American Railway Association. It is joint sponsor for four sectional committees, as follows: Insulated wires and cables other than telegraph and telephone (with 10 other organizations); specifications for cross ties and switch ties (with the United States Forest Service); specifications for railway bridges (including movable bridges as a separate subject).

American Refractories Institute, Technical Department, Stuart M. Phelps, director of research and tests, Mellon Institute, Pittsburgh, Pa. The pamphlet covering malleable-foundry refractories issued by the division of simplified practice of the National Bureau of Standards represents effective cooperation on the part of this institute. Other activities include surveys of several refractory commodities and tentative specifications for boiler refractories and for fire-clay brick for malleable furnaces with removable bungs, and for annealing ovens.

American Road Builders' Association, C. M. Upham, engineer-director,

National Press Building, Washington, D. C. This association was organized in 1902 to disseminate educational and scientific information on highway construction, maintenance, and operation. Its original endeavors were limited to the improvement of highways in the United States, but its recently expanding activities have resulted in the development of a much larger field, which includes Canada, Central and South America, and many European countries. It operates through eight separate and distinct divisions, namely engineers and officials, county highway officials, city officials, European, Pan American, membership-at-large, contractors, and manufacturers. By means of committees and through the research and investigational work of the engineering staff of the association these divisions obtain and distribute information. In addition, general committees are organized to study and investigate various factors connected with the development of highways in cooperation with the engineering staff. The present activities include studies on highway finance, equipment, depreciation, equipment purchasing methods, grade crossings, airport surfacing, grading methods and grading equipment, low-cost road construction, location and guardrail. The joint equipment purchasing methods committee, comprised of representatives of the American Association of State highway officials and this association, in cooperation with the National Bureau of Standards, has completed a survey on methods of selecting, specifying, maintaining and purchasing highway equipment used by State highway departments throughout the country in an effort toward standardization of purchasing methods. A report was presented in January, 1930, which included recommendations formally adopted by the joint committee on part of the information submitted. This same committee will attempt to complete the report during the current year. Other standardization studies now being undertaken by this association include compaction of embankments, the placing of centrally mixed concrete and treatment of subgrades and pavement bases. During the past year specifications were formulated for weighing devices for concrete aggregates. The city officials and county officials divisions, each functioning in their own field of activity, are organized as separate units, each having its

own officers and board of directors and committees covering the entire field of county and city highway activities. A committee on airport drainage and surfacing organized in 1929 is now cooperating with the Chamber of Commerce of the United States of America and the American Engineering Council. The Pan American division is composed of representatives from Central and South America. The division now includes in its membership 450 State and Government officials and engineers from every country in North, Central, and South America. The European division recently organized includes a similar membership in European countries. These two divisions through their many contacts are distributing information on American methods of highway construction, maintenance, operation, and finance in foreign countries. Recently a statistical and service department was added to the organization to furnish information on all phases of highway work to meet a rapidly increasing demand from all branches of the industry. Encouragement of student engineers from Latin America to come to this country to study methods in use in the United States has recently been given impetus by the granting of scholarships by the association. Engineering activities of the association have been carried on for some time through the work of committees, and by the association's engineering staff working in cooperation with the various committees. Investigational work is carried on throughout the year, and reports are presented and discussed at the annual convention held in January of each year and published in the annual proceedings of the association. In connection with the convention an exposition is held demonstrating the latest developments in road and street building machinery, materials and methods. The association maintains representation on the sectional committee on methods of testing road and paving materials.

American Sanatorium Association, E. S. McSweeney, chairman, committee on standardization, 132 East Thirty-sixth Street, New York, N. Y. Standards relating to the rating as to location, construction of buildings, and administration of the tuberculosis sanatoriums and hospitals in the United States have been promulgated by this organization. These standards have been adopted by the National Tuberculosis Association and the Sana-

torium Conference of the Metropolitan Area in New York City; also by the Welfare Council in New York City as minimum standards for convalescent homes.

American Society of Agricultural Engineers, Raymond Olney, St. Joseph, Mich. Several years ago this organization developed and adopted a testing and rating code for farm tractors which has been accepted as standard by the farm-equipment industry. It is now engaged in completing a third revision of its standards and recommended practices for power take-off for agricultural tractors, and for standard disk blades for disk plows, harrows, drills, listers, and cultivators. It has also under way a project for standardizing belt speeds for agricultural machines. The society is formulating a comprehensive program involving all phases of the application of engineering to agriculture, including power and machinery, land reclamation, and rural electrification. The society maintains representation on five sectional committees.

American Society of Bakery Engineers, Victor E. Marx, secretary, 1541 Birchwood Avenue, Chicago, Ill. Standards relating to high-speed dough mixers, flour-handling units, sifters, bolters, flour hoppers, and water tanks have been recommended for adoption by the standardization committee of this society. These standards were prepared in cooperation with the Bakery Equipment Manufacturers Association. The society is officially represented on the sectional committee on frame dimensions of electric motors.

American Society of Civil Engineers, George T. Seabury, secretary, 33 West Thirty-ninth Street, New York, N. Y. Committees of this society have been organized to deal with the following projects: Irrigation hydraulics, concrete and reinforced concrete arches, steel columns, stresses in railroad track, bridge design and construction, cement, earths, and foundations. The society is represented on the joint concrete culvert pipe committee with six other organizations. In cooperation with the American Public Health Association, it has adopted standard definitions of terms used in sewerage and sewage disposal practice. During the past year the committee on lock valves of the waterways division of the society compiled a manual dealing with different types of lock valves now in use at various canals and waterways. A joint committee composed of representatives of this association and

the American Railway Engineering Association formulated general specifications for steel railway bridges. The society is joint sponsor for three sectional committees, as follows: Structural steel shapes (with the Association of American Steel Manufacturers and the Society of Naval Architects and Marine Engineers), manhole frames and covers (with the American Standards Association Telephone Group), and scientific and engineering symbols and abbreviations (with four other organizations).

American Society of Heating and Ventilating Engineers, A. V. Hutchinson, secretary, 51 Madison Avenue, New York, N. Y. The society's work in research and standardization pertaining to heating and ventilating has resulted in the development and adoption of a number of standards, codes, and testing methods covering the following subjects: Heat transmission through walls, minimum requirements for the heating and ventilation of buildings, steam heating solid-fuel boilers, testing and rating steam unit heaters, heating and ventilating garages, standard and short form heat balance for testing low-pressure steam heating solid-fuel boilers, installation of gravity warm air furnaces, heating boilers, rating radiators, testing fans, and measuring degree of ventilation perfection. The society's research program is conducted at its own laboratory located at the United States Bureau of Mines, Pittsburgh Experiment Station and at 10 universities where cooperative research is handled. In the development of a number of test codes, the society has had the active cooperation of the Industrial Unit Heater Association, National Association of Fan Manufacturers, American Society of Mechanical Engineers, National Warm Air Heating Association, and the National Fire Protection Association. Committees of this society are now engaged in the preparation of other codes relating to the heating and ventilation of buildings, including testing and rating concealed radiation, air-cleaning devices, and oil-burning devices. The society is joint sponsor for two sectional committees on code for ventilation and safety code for exhaust systems.

American Society of Mechanical Engineers, Calvin W. Rice, secretary, 29 West Thirty-ninth Street, New York, N. Y. Sixteen professional divisions of the society have been organized on aeronautics, applied mechanics, fuels, hydraulics, iron and

steel, machine-shop practice, management, materials handling, national defense, oil and gas power, petroleum, power, printing machinery, railroad, textiles, and wood industries. Since January, 1928, each professional division has had its own quarterly publications. The technical committee activity of the society has grown very rapidly during the past 11 years, until now approximately 1,600 engineers and others are serving on the 375 committees for which the society is sponsor or joint sponsor. In this work 210 organizations cooperate. Under the main research committee 39 special research committees have been organized. Some of these projects have grown out of the activities of standard committees. At the present time some 29 research workers are engaged on a variety of projects, as follows: Boiler-furnace refractories, lubrication, steam tables, elevator safety devices, strength of gear teeth, existing supplies of hardwoods, cutting metals, cutting fluids, mechanical springs, effect of temperature on properties of metals, boiler feed-water studies, velocity measurement of fluid flow, removal of ash as molten slag from powdered-coal furnaces, heavy duty antifriction bearings, etc. Six research fellows at the National Bureau of Standards are working on the experimental program of these research committees. New projects in the Diesel engine, machine-shop practice, textile, printing, and hydraulic fields are 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 27 sectional committees on standards and 5 sectional committees preparing safety codes. The projects covered by the standards committees are: Transmission chains and sprockets; shafting; plain limit gages for general engineering work; ball and roller bearings; gears; standardization and unification of screw threads; pipe flanges and fittings; bolt, nut, and rivet proportions; scheme for the identification of piping systems; small tools and machine-tool elements; scientific and engineering symbols and abbreviations; screw threads for fire-hose couplings; plain and lock washers; machine pins; standards for drawings and drafting-room practice; code for pressure piping; standards for graphic presentation; pipe threads; wire and sheet-

metal gaging systems; wrought-iron and wrought-steel pipe and tubing; electric motor frame dimensions; screw threads for small hose couplings; speeds of driven machines; plumbing equipment; rolled threads for screw shells of electric sockets and lamp bases; stock sizes, shapes, and lengths for hot and cold finished iron and steel bars; and pressure and vacuum gauges. The safety code committees are drafting national codes on mechanical power-transmission apparatus; elevators; conveyors and conveying machinery; machinery for compressing air; and cranes, derricks, and hoists. 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 8 sections and interpretations. The code has been officially adopted by 19 States and 16 cities in this country. These codes cover rules for the construction of power boilers, boilers of locomotives, heating boilers, material specifications, miniature boilers, rules for inspection, unfired pressure vessels, and for the care of power boilers and other pressure vessels in service. 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 19 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. This group of codes covers also such general topics as general instructions; definitions and values; fuels; stationary steam boilers; reciprocating steam engines; steam turbines; reciprocating steam-driven displacement pumps; centrifugal and rotary pumps; displacement compressors and blowers; centrifugal and turbo compressors and blowers; complete steam-power plants; condenser, water heating, and cooling equipment; refrigerating systems; evaporating apparatus; steam locomotives; gas producers; internal-combustion engines; hydraulic power plants; instruments and apparatus; and speed-responsive governors. The society has published in pamphlet form 36 dimensional standards, 10

safety codes, 7 research reports, and 23 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 American Society of Mechanical Engineers 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 mechanical catalogue special notations are employed to indicate those firms supplying equipment in conformity with standards approved by the American Standards Association.

American Society for Municipal Improvements, C. W. S. Sammelman, secretary, 4359 Lindell Boulevard, St. Louis, Mo. Standard specifications have been adopted by this organization for municipal contract forms, sewers, paving materials, and kindred subjects. The society's specifications are kept in harmony with those of the American Society for Testing Materials. The movement resulting in the simplified practice recommendation relating to asphalt was initiated by this society in cooperation with the Asphalt Institute. It maintains standing committees dealing with the following subjects: Street paving, design, construction, and maintenance; sewerage and sanitation; refuse disposal and street cleaning; city planning; street and traffic lighting; traffic control; water works; municipal legislation and finance; public utilities; airports and landing fields; bituminous pavements; brick pavements; cement concrete pavements; stone block pavements; street-railway pavements and track construction; sidewalks and curbs; and subgrade and foundations. The society is joint sponsor (with three other organizations) for the sectional committee on method of test for penetration of bituminous materials.

American Society of Refrigerating Engineers, David L. Fiske, secretary, 37 West Thirty-ninth Street, New York, N. Y. A standard measurement for refrigeration performance known as the "standard ton" has been adopted by this society, and a standard test code for refrigerating sys-

tems has been formulated, both of which are in harmony with those of the American Society of Mechanical Engineers. It has also adopted specifications for synchronous motors for direct-connected refrigerating compressors, and a test code for steam-driven ice plants. It cooperated in the preparation of the simplified practice recommendation for ice cake sizes. The society served as sponsor for the safety code for mechanical refrigeration, and as joint sponsor, with the Bureau of Home Economics of the United States Department of Agriculture, for the standardization of refrigerators.

American Society of Safety Engineers. (See National Safety Council.)

American Society of Sanitary Engineering. A. R. McGonegal, president. District Building, Washington, D. C. This organization cooperated with the Building Code Committee of the United States Department of Commerce in the formulation of the National Standard Plumbing Code. In cooperation with the National Bureau of Standards it is conducting tests of plumbing equipment in high buildings. The society is joint sponsor with the American Society of Mechanical Engineers for the sectional committee on the standardization of plumbing equipment and is officially represented on other sectional committees dealing with standardization of screw threads for hose couplings (other than fire-hose couplings), pipe threads, and industrial safety standards.

American Society for Steel Treatment. 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 heat treatments of steels, as follows: Plain carbon tool, 18 per cent tungsten high-speed; nonshrinking, nondeforming, oil hardening tool; finishing of steel; taps and milling cutters; dies for die castings; plain and alloy steel die blocks; blanking dies and punches; shear blades; chisels; carbon steels (S. A. E. series); carbon and alloy steel castings; sling and crane chain; alloy gears; plain carbon and alloy spring steel; nickel and nickel-chromium steels; permanent magnet steels; and carburizing and heating treatment of cam shafts, gears, and piston rings. Through a joint committee composed of representatives

of the American Society for Testing Materials, the Society of Automotive Engineers, and this society, it adopted standard definitions of terms relating to heat treatment operations. 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, heading and roll threading of bolts and nuts, heat treatment of locomotive forgings, nitriding, quenching, plastic deformation in pure iron, melting of steel, and hot mechanical working of steel. The society is officially represented on the sectional committee on specifications for zinc coating of iron and steel.

American Society for Testing Materials. (See Chapter VII, p. 274.)

American Specification Institute. Gardner C. Coughlen, acting executive secretary, 205 West Wacker Drive, Chicago, Ill. One of the functions of this organization is the development of standardized specifications to supplement the drawings covering the construction and equipment of various kinds of structures. This work is reflected in the institute's publication, the Specification Record, the fourth volume of which has recently been issued. It contains specifications, outlines of specifications, and similar data in comparative form.

American Standards Association. (See chapter VII (p. 269).)

American Veneer Package Association. Mrs. J. F. Peifer, acting secretary, 900 F Street NW., Washington, D. C. Actively interested in welfare and standing of the veneer package industry, this association looks to the establishment and maintenance of proper standards of materials and workmanship for the industry's products. In cooperation with carriers, shipping agencies, and others intimately concerned, it is aiding in the preparation of strength specifications for fruit and vegetable containers. It maintains committees for standardizing factory processes, and for the study of problems relating to economical and efficient containers.

American Veterinary Medical Association. Dr. H. Preston Hoskins, secretary-editor, 537 Book Building, Detroit, Mich. The committee on veterinary biological products of this association is endeavoring to bring about a standard classification, including nomenclature, of all biological products now in use for preventing or

curing diseases of animals. It is planning to classify all veterinary biologics into three major groups, as follows: Group A, those veterinary biologics which are efficient, or whose worth has been proven; group B, those biologics which are still in the experimental stage; and group C, those biologics which possess little or no value. The committee on education of this association is undertaking work which may lead to standardization of the veterinary curriculum in the veterinary colleges of the country. The special committee on standard milk control code has been cooperating with officials of the United States Public Health Service in an effort to secure approximately uniform milk control practice. At various times this association has recommended the adoption of a uniform health certificate to accompany animals being shipped interstate.

American Vitrified China Manufacturers' Association, Arthur E. Mayer, care of Mayer China Co., Beaver Falls, Pa. This organization cooperated in preparing the simplified practice recommendations relating to chinaware for hotels, dining cars, hospitals, and restaurants, and hospital plumbing fixtures.

American Walnut Manufacturers' Association, Burdett Green, secretary, 616 South Michigan Boulevard, Chicago, Ill. This association has adopted standard grading rules for American black walnut lumber which are generally accepted as standard both at home and abroad. The possibility of manufacturing and classifying veneers on a standard basis has recently been undertaken by its committee on veneers. In the past year the association adopted standard 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. The association, through its committee on simplification of forms and methods, sponsored the movement which resulted in the formulation of the simplified practice recommendation for warehouse forms. It is represented on the sectional committee on safety code for mechanical refrigeration.

American Water Works Association, Malcolm Pirnie, chairman, committee on water works practice, 25 West Forty-third Street, New York, N. Y. In its Manual of Water Works Practice are included the association's standards for cast-iron water pipe and

special castings, hydrants and valves, and cold-water meters (displacement, current, compound, and fire service). In cooperation with the American Public Health Association, this organization has published the sixth edition of the book relating to standard methods of water analysis. It is joint sponsor for two standardization projects, as follows: Specifications for cast-iron pipe and special castings (with three other organizations), and screw threads for fire-hose couplings (with two organizations). It is also officially represented on seven other sectional committees on manhole frames and covers, plumbing equipment, pipe threads, pipe flanges and fittings, code for pressure piping, wrought-iron and wrought-steel pipe and tubing, and zinc coating of iron and steel.

American Waxed Paper Association, Paul S. Hanway, manager, 342 Madison Avenue, New York, N. Y. Actively engaged in simplifying and standardizing the commodities produced by waxed paper manufacturers, this association is establishing standards for quality, weight, and sizes of all such products. Its standard requirements for packaging has resulted in the elimination of many needless sizes.

American Welding Society, M. M. Kelly, 33 West Thirty-ninth Street, New York, N. Y. Technical committees, as well as the American Bureau of Welding, which acts as the research department of the society, are carrying on important standardization work in the welding industry. A bulletin on welding and cutting nomenclature, definitions, and symbols prepared by one of the technical committees has been published by the society. Another committee appointed for the purpose of assisting code-making bodies and city building departments in the way of regulating welding in building construction has prepared a code relating to fusion welding and gas cutting in building construction. The committee on standardization of gages has proposed the adoption of five standard types of gages for measuring butt and fillet welds. The committee on building codes has completed a new edition of the code for fusion welding and gas cutting in building construction. It has under preparation sections on welded piping and tankage. Another committee is cooperating with the boiler code committee of the American Society of Mechanical Engineers in the preparation of specifications which can be used in connection with the unfired

pressure vessel code. Another committee is cooperating with the boiler code committee of A. S. M. E. in the preparation of welding code for pressure piping. Two subcommittees of the marine construction committee are engaged in projects relating to marine boilers and hull construction. One subcommittee is cooperating with the Steamboat Inspection Service of the United States Department of Commerce in the preparation of specifications, while the other is undertaking the preparation of a code for marine welding. The committee on qualification tests for welders has prepared 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 on codes for compressed-air machinery, pressure piping, specifications for tubular steel poles, and definitions of electrical terms, electric welding, electric welding dies and electrode holders; on A. S. T. M. committees dealing with wrought copper and copper alloys, and specifications for steel for fusion welding; on A. E. R. E. A. way and structures committee on standard specifications for welding rods; and on the advisory committee of the Merchants' Association of New York on the revision of New York City Building Code.

American Wood-Preservers' Association, Horace L. Dawson, secretary, 1104 Chandler Building, Washington, D. C. Listed in its Manual of Recommended Practice are 43 standards and specifications dealing with preservative treatments of wood which have been formulated and adopted by this association. During the past year this association has adopted tentative revisions of its standards dealing with the following subjects: Method for determining specific gravity of creosote fractions, method for determining the specific gravity of creosote oil, method of sampling creosote oil in tank cars, standard distillation of creosote oil, standard definition of creosote, and standard method for the determination of coke residue in creosote oil. It has also approved a tentative standard for determining the approximate strength of zinc chloride solution. These tentative standards are not permanently adopted until they have had a year's trial and until they have been reconsidered at the annual

meeting. This association is officially represented on the sectional committee on specifications for wood poles.

American Zinc Institute, Stephen S. Tuthill, secretary, 27 Cedar Street, New York, N. Y. The standardization activities of this organization are conducted in cooperation with other organizations, especially the American Society for Testing Materials and the American Standards Association. It is represented on the mining standardization correlating committee and is joint sponsor, with the American Society for Testing Materials, for the sectional committee on zinc and zinc ores. It is also represented on the sectional committees on specifications for zinc coating of iron and steel and on wire and sheet metal gages.

Arkansas Soft Pine Bureau, W. J. St. John, assistant secretary, Little Rock, Ark. The registered symbol of this bureau is affixed to all stock shipped by its member mills, the stock having been grade marked as recommended by the United States Department of Commerce. American standards for yard and finishing lumber are embodied in the specifications for grading soft-pine lumber issued by this bureau.

Artistic Lighting Equipment Association, Charles L. Benjamin, managing director, 420 Lexington Avenue, New York, N. Y. Committees of this association are actively engaged in standardizing wiring devices for use in the lighting-equipment industry; also outlet boxes and standard specifications for architects' use in connection with lighting equipment. It maintains representation on the sectional committee for pipe threads.

Ash Handle Association, C. E. Bell, secretary, care of La Fontaine Handle Co., Decatur, Ind. Much of the standardization work of this association is carried on in cooperation with other interested organizations under the auspices of the National Association of Wood Turners. It has cooperated in the establishment of grading rules and marking of ash handles which are set forth in the simplified practice recommendation relating to these items.

Asphalt Institute, J. E. Pennybacker, managing director, 801 Second Avenue, New York, N. Y. This organization, formerly known as the Asphalt Association, conducts its standardization work in cooperation with the American Society for Testing Materials for standard tests and specifications for asphaltic products; with the

American Society for Municipal Improvements in the formulation of specifications for the construction of various types of asphalt pavements; and with the United States Bureau of Public Roads in the simplification of specifications for low-cost road work. The institute has adopted the following standards and specifications for road construction: Asphalt macadam surface course (penetration method), asphaltic concrete surface course (coarse and fine graded aggregate types), sheet asphalt binder and surface course; asphaltic concrete binder and surface courses, asphalt macadam base (penetration method), and asphaltic concrete base. The institute cooperated in the formulation of the simplified-practice recommendation relating to grades of asphaltic products. It is officially represented on the sectional committee on methods of testing road and paving materials.

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 carried on through its manufacturing and industrial research committee, in cooperation with the Underwriters' Laboratories, the American Society for Testing Materials, and the Federal Specifications Board. It 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 with respect to saturation point of felt used in manufacturing shingles. By official unanimous resolution all the members of the institute have signified their willingness to supply asphalt and roofing materials complying with Federal Government specifications. A research associate is maintained at the National Bureau of Standards doing research work on problems connected with the asphalt-roofing industry.

Associated Cooperaage Industries of America, Louis F. Horn, secretary, 2008 Railway Exchange Building, St. Louis, Mo. During the past year, the committees of this association revised the standard grade rules and specifications covering tight cooperaage material, and also the rules governing sales and settlements. In cooperation with the Bureau of Explosives, the committees revised the specifications covering tight and slack wooden barrels and kegs for use in the transportation of explosives and other dangerous articles. These specifications in revised form were adopted by the Interstate

Commerce Commission and made effective on October 1, 1930. The tight barrel group of this association has adopted the recommendation of its committee with respect to standard specifications for steel hoops for tight barrels and kegs. This association also cooperated with the American Railway Association, Freight Container Bureau, in the promulgation of standard specifications for slack barrels for potatoes and other vegetables. It is now actively working with the Rosin Barrel Manufacturers Association in developing uniform standards for rosin barrels. For the purpose of insuring greater uniformity and efficiency in the classification of barrels and kegs, this association, during the past year, appointed a classification committee composed of tight barrel manufacturers to further standardize and classify tight barrels and kegs, other than I. C. C. barrels and kegs, used in packing various commodities.

Associated Factory Mutual Fire Insurance Companies, Inspection Department, C. W. Mowry, manager, 184 High Street, Boston, Mass. This association issues numerous pamphlets on various subjects pertaining to fire protection and fire prevention. During the past year it has published specifications or recommended practices for: Pyroxylin plastic; pyroxylin lacquer (hazards and precautions); safeguards for the application and drying of japan, enamel, paint and varnish; valves, indicator posts and hydrants; gravity water tanks and steel towers; fire-hose couplings and playpipes and suggestions for hose houses; decay of wood in industrial buildings; electrical apparatus and fittings; and fire-protection appliances. It has also issued rules for installing dry pipe sprinkler equipments; installing sprinkler equipments (automatic and open systems); electric light and power equipments, consisting of the "National Electrical Code" with explanatory notes; and laying cast-iron water pipes in factory yards. Manufacturing firms are permitted to use the association's identification mark of approval on devices specifically approved by the association as to both design and construction. It is a member of the American Standards Association fire protection group, and is officially represented on nine sectional committees dealing with safety codes and materials and equipment for fire-fighting devices. The inspection department of this organization also works on standardization projects by means of representation on

committees 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.), G. W. Walbridge, general manager pro tempore, Munsey Building, Washington, D. C. This association has developed and approved a number of standards, including: Equipment rental agreement; cost-plus-a-fee contract; contracts for engineering, building, and municipal construction; highway estimate forms; Government form of contract; and several forms of questionnaires of moment to the contracting industry. It has adopted the American Institute of Architects' forms for the construction of buildings, and in cooperation with the American Society for Municipal Improvements it has developed a standard bidding and awarding procedure form. Through its mixer manufacturers' bureau this association has adopted concrete mixer standards, now in their fourth revision. A standard credit system evolved by this committee is now in operation in many places. The association has also adopted a manual of safety practices in construction work. It is officially represented on the Allied Construction Industries Committee with 12 other organizations, the object of this committee being to promote closer cooperation among the many and diverse components in the contracting industry. The association maintains representation on eight sectional committees dealing with materials used in building construction.

Associated Knit Underwear Manufacturers of America, Roy A. Cheney, secretary, Mann Building, Utica, N. Y. The association has adopted a standard method for testing the breaking strength of knitted fabrics, and washing instructions for knit rayon underwear and knit wool and wool-cotton underwear. Two specifications relating to men's medium-weight undershirts and drawers have been developed by a committee of this association and submitted to the Federal Specifications Board for adoption. The committee is now engaged in the preparation of six additional specifications covering flat-knitted cotton and wool-cotton shirts and drawers for Army and Navy use. The association is also cooperating with the Bureau of Aeronautics, United States Navy Department in developing suitable

specifications for underwear to be used by aviators when flying in winter and in high altitudes. One of the chief functions of the association has been the development of proper sizes, measurements, and methods of measuring for the various types of knitted underwear. It cooperated in the establishment of the commercial standard for regain of mercerized cotton yarns, and for boys' blouses, waists, shirts, and junior shirts. At the present time, the association has adopted 49 size specifications for men's, women's, boys', children's, and infant's knit underwear and is now working toward the adoption of additional sizes. The association has adopted a standard mark which is protected by law to be used by manufacturers on garments made to measurements certified to conform to tables compiled by the National Bureau of Standards under license from the association. 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 willfully abused. The association has adopted certain symbols for designating different models of knit underwear, a color code for designating the size of single cotton yarns by the color of cone upon which they are wound, and five sizes of boxes as standards for packing all types of men's and boys knit underwear. The future work of the association consists in simplification of sizes of underwear labels in which it is cooperating with the division of simplified practice of the National Bureau of Standards; in standardization of the position of buttons on children's taped underwear in cooperation with the division of trade standards; and in the investigation of essential characteristics of knitted fabrics. The association maintains a research associate at the National Bureau of Standards engaged in the standardization and simplification of underwear sizes and methods of manufacturing.

Associated Metal Lath Manufacturers, Erwin M. Lurie, commissioner, 1821 Engineering Building, Chicago, Ill. Numerous pamphlets on plaster and stucco have been published by this body. Other publications include complete specifications for metal-lath construction, and a booklet which deals with fire-protection engineering as applied to construction and occupancy of buildings. This booklet also contains recommended building ordinances for

protection to life and preservation of property. It also publishes the partition handbook in which various types of fire-resistive partitions are discussed from the standpoints of space saving, sound insulation, cost, etc. This association initiated the movement for the elimination of excess varieties and sizes of metal lath which resulted in the simplified practice recommendation relating to this item. This association maintains a staff of engineers who assist in the formulation of building-code requirements and plastering ordinances for adoption by cities or States. It also cooperates in standardization work by representation on various committees of the American Concrete Institute, National Fire Protection Association, American Society for Testing Materials and others. It has also cooperated with the Building Code Committee of the United States Department of Commerce. The association also sponsored the movement for better plastering and for this purpose organized The National Council for Better Plastering, which cooperates with organizations of architects, plastering and lathing contractors and journeymen.

Associated Tile Manufacturers (Inc.), M. A. Illing, secretary, 420 Lexington Avenue, New York, N. Y. The objects of this association are: To establish basic specifications for all types of tile work for the use of architects and specification writers; to standardize tile sizes and shapes; and to establish uniform names, definitions, grades and standard methods for grade sealing of packages. It has issued a publication relating to basic specification for tile work and also one dealing with standard shapes of glazed tiles and trimmers, which recently has been supplemented by a standardized trimmer index sheet showing the cross sections of all standard wall tile trim. The association is cooperating in the revision of the simplified practice recommendation relating to clay tiles for floors and walls, this project having been originally sponsored by the association. The association has adopted uniform grade names and a color scheme for grade marking and issuing certificates to accompany packages of tiles manufactured to comply with the simplified practice recommendation relating to this group of commodities.

Association of American Feed Control Officials, L. E. Bopst, secretary, College Park, Md. In cooperation with the American Feed Manufacturers Association, this association

has formulated and adopted official standards and definitions of feeding stuffs. The methods of analysis of the Association of Official Agricultural Chemists of North America have been adopted as the official methods of this association. The standards and definitions adopted cover: Alfalfa, apples, barley, buckwheat, corn, cottonseed, linseed and flax, oil cake, oats, peanuts, rice, rye, velvet beans, wheat, hard spring wheat, winter wheat, mineral feed, and animal, brewers, distillers, and fish by-products. It has also formulated tentative definitions for table scrap meal, crab meal, shrimp meal, dried skimmed milk, condensed skimmed milk, condensed cultured skimmed milk, and milk sugar feed. This association has also adopted a uniform feed law which is being used as a model for adoption by the various States.

Association of American Soap and Glycerine Producers (Inc.), Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. This association's standardization work is being carried on 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. (See p. 319.)

Association of American Steel Manufacturers, J. O. Leech, secretary, care of Carnegie Steel Co., Pittsburgh, Pa. This association, with 10 other organizations, was officially represented on the joint committee on phosphorus and sulphur in steel. It has formulated and issued standard practices covering methods of sampling for check analysis; permissible rolling variations in the size of hot-rolled bars; permissible variations in weight, thickness, size, and flatness of sheets and light plates blue annealed; and standard specifications for structural and boiler steel, and concrete reinforcement bars. The association is officially represented on six committees of the American Standards Association.

Association of American Wood Pulp Importers, G. W. Oliphant, president, 200 Fifth Avenue, New York, N. Y. Through the work of a joint committee composed of representatives of this association, the American Paper and Pulp Association, and the Technical Association of the Pulp and Paper Industry, official rules relating to the weighing, sampling, and testing of wood pulp for moisture have been approved and adopted. The association is working on the standardization

of contract forms for use in sales of all imported pulp from Sweden, Norway, Finland, and Germany. The association maintains a traffic committee which cooperates with railroads, steamship companies, and storage warehouses in the establishment of a uniform procedure and standard set of storage and rail freight rates.

Association of Asphalt Paving Technologists, Charles A. Mullen, secretary-treasurer, 980 St. Antoine Street, Montreal, Canada. In cooperation with the Asphalt Institute this organization is assisting in the formulation of standards and specifications for asphalt and asphalt paving. It has research committees working on problems affecting the asphalt paving and roofing industries.

Association of Edison Illuminating Companies, Preston S. Millar, secretary, Eightieth Street and East End Avenue, New York, N. Y. This association has cooperated with the Illuminating Engineering Society in preparing specifications for residence-lighting luminaries. It 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 (with nine other organizations), and code for electricity meters (with the National Bureau of Standards and the National Electric Light Association).

Association of Electragists, International, Lawrence W. Davis, general manager, 420 Lexington Avenue, New York, N. Y. The compilation of standards for electric-wiring installations has been completed by the standards committee of this association. The standards include definitions, types of wiring required under given conditions, specifications for materials and apparatus and their installation and general requirements. It is joint sponsor, with the American Institute of Architects and the American Institute of Electrical Engineers, for a sectional committee on symbols for electrical equipment of buildings.

Association of Governmental Officials in Industry of the United States and Canada, Louise E. Schutz, secretary-treasurer, Division of Women and Children, Industrial Commission, St. Paul, Minn. One of the chief functions of this organization is the promulgation and adoption of safety codes for the protection of industrial workers. Practically all of the work relating to industrial safety codes is carried on

through official representation on 22 sectional committees of the American Standards Association. The association is joint sponsor with the Laundryowners' National Association of the United States and Canada and the National Association of Mutual Casualty Companies for the sectional committee on safety code for laundries functioning under American Standards Association's rules of procedure. During the past year, a committee was appointed to conduct a campaign for the purpose of interesting all State Labor Departments and Industrial Commissions in safety-code work and to urge the adoption of safety codes which have already been formulated and approved as American standards by the A. S. A. The association is officially represented on the safety Code Correlating Committee which functions under the rules of the American Standards Association.

Association of Iron and Steel Electrical Engineers, John F. Kelly, managing director, 1010 Empire Building, Pittsburgh, Pa. This society is concerned with the standardization of electrical, combustion, lubrication, and safety engineering equipment, and also operating practices in steel mills. It has, through the work of several committees, adopted standard dimensions for ball and roller bearings used in steel mill motors, thus making possible the interchange of any of several makes of antifriction bearings in a standard motor. It has in process of compilation the standardization of data in connection with antifriction bearings for all electrically operated, mill-type apparatus, including overhead traveling crane, roll necks, and auxiliary machinery. Committee recommendations have resulted in the adoption of specifications for electric overhead traveling cranes—heavy duty, steel mill type, mill type motors and large motors for rolling mill drives. This association also recommends the observance of certain rules in relation to the operation of overhead traveling cranes and engine stops. It also prints standard guide forms for use in ordering large rolling mill motors and direct-current controllers. A special committee is now working on a method whereby all magnetic controllers will bear the same wiring symbols and markings. A committee of the lubrication engineering division is at present making an exhaustive study of lubricants, methods, practices, systems, etc., as applicable to the iron and steel industry.

Association of Manufacturers of Chilled Car Wheels, G. E. Doke, president and secretary, McCormick Building, Chicago, Ill. This association has adopted: Specifications for chilled-tread wheels for standard railway and industrial service, foundry standard inspection and tests for chilled-tread car wheels, and a uniform guaranty for 33-inch chilled-tread car wheels. In cooperation with the mechanical division of the American Railway Association, it has formulated and adopted specifications for chilled-tread wheels for locomotives, tenders, and cars. It is now engaged in the preparation of a third revision of the foundry standard inspection and tests for chilled-tread wheels. For the purpose of encouraging and facilitating the use of this specification the association maintains a corps of inspectors who make semiannual inspections of its member foundries. The association maintains representation on the sectional committee on recommended practice for coal mine tracks, signals, and switches, functioning under American Standards Association procedure.

Association of Official Agricultural Chemists, W. W. Skinner, secretary, post-office box 290, Pennsylvania Avenue Station, Washington, D. C. Standards and methods of analysis for agricultural products and other materials used in the agricultural industry have been formulated and adopted by this association. It has published a book containing methods of analysis which are accepted as authoritative in matters at issue before Federal and State courts. It 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 Pharmacopoeia on methods of tests for medicinal products.

Association of Official Seed Analysts of North America, F. S. Holmes, secretary, University of Maryland, College Park, Md. The work of this association is conducted by a research committee composed of a chairman who is appointed by the president, and other members who are selected by the chairman. Greater uniformity in the results of purity analyses and germination tests as conducted by the several laboratories of the association is the object sought. The association took an active part in the formulation of rules for seed testing which have been promulgated

by the United States Department of Agriculture and adopted by this association. In cooperation with various seedmen's organizations, this association assisted in the preparation of a model uniform State seed bill and is conducting a campaign for its enactment into law by the legislatures of the various States of the Union.

Association of Pyroxylin Coated Fabric Manufacturers, C. Stewart Comeaux, secretary, 103 Park Avenue, New York, N. Y. During the past year this association cooperated with cotton textile manufacturers in the preparation of standard specifications for cotton goods used in the manufacture of pyroxylin-coated fabrics, effective January 1, 1931.

Association of Railway Electrical Engineers, J. A. Andreucetti, secretary, Chicago & North Western Terminal Station, Chicago, Ill. The manual of this association has recently been revised by the manual committee. It contains all the recommended practices, methods, specifications, and other data approved by the association for the use of engineers in the railway electrical field. Specifications have been prepared covering electric-train lighting; locomotive electrical equipment; electrical construction, installation, and maintenance of electric equipment; motors and control equipment; illumination; electric welding and metal heating; and other miscellaneous items. The association is joint sponsor, with nine other associations, for the sectional committee on insulated wires and cables for other than telephone, telegraph, and signal use.

Association of Wilton and Brussels Manufacturers of America, Henry I. Magee, secretary, 650 West Lehigh Avenue, Philadelphia, Pa. The various methods employed in weaving Wilton carpets and rugs have been defined and standardized by this association. It has also established a standard definition for Wilton fabric.

Automotive Electric Association, Earl Turner, manager, 1365 Ontario Street, Cleveland, Ohio. This organization represents a branch of the automotive industry specializing in the installation of electrical units, storage batteries, and related devices and materials used in motor cars and coaches. Several years ago the association published performance specifications for electrical units and storage batteries in order to reduce the number of sizes and types of generators and starting motors for motor cars. During the

past three years the standardization committee of this association has been actively engaged in the preparation of a manual which will embrace specifications covering the size of generators (measured in output) and the size of storage batteries (measured in physical dimensions as well as ampere-hour capacity), necessary to illuminate satisfactorily and operate various sizes of motor coaches. The association is officially represented on committees of the Society of Automotive Engineers.

Better Bedding Alliance of America. S. J. Mills, secretary, 608 South Dearborn Street, Chicago, Ill. This is a national association of mattress and pillow manufacturers organized for the purpose of improving ethical standards in the industry, to promote the use of better bedding, and to combat misrepresentation of filling materials. In order to prevent public deception and unfair competition, this association is promoting the passage of sanitary bedding laws which empower State inspectors to inspect bedding factories to insure that each article of bedding is properly labeled as to the kind of filling material used and as to whether it is new or previously used. This organization cooperated with the United States Department of Agriculture in the preparation and adoption of standard grades for cotton linter, and with the Department of Commerce in the establishment of the simplified practice recommendation relating to bed sizes. It is now carrying forward work in an attempt to reduce the number of sizes of feather pillows.

Binders Board Manufacturers Association. O. M. Porter, secretary, 122 East Forty-second Street, New York, N. Y. The interests of this organization are affiliated with those of the American Paper and Pulp Association. In cooperation with the Employing Bookbinders of America, it assisted the division of simplified practice of the National Bureau of Standards in the promulgation of the simplified practice recommendation covering standard sizes of binder board. Work is now going forward in correlating these standard sizes with those of book covers.

Biscuit and Cracker Manufacturers Association of America. (See Technical Institute of the Biscuit and Cracker Manufacturers' Association, p. 358.)

Bolt, Nut and Rivet Manufacturers Association. Evans Ward, chairman, standardization committee, care of Russell, Burdsall and Ward Bolt &

Nut Co., Port Chester, N. Y. The standardization committee of this association is actively carrying forward the work of establishing standards for carriage bolts, fin-head bolts, ribbed neck bolts, button-head machine bolts, countersunk-head machine bolts, and countersunk-head carriage bolts. The association maintains representation on the sectional committees on screw threads for bolts, machine screws, nuts, and commercially tapped holes, and on bolt, nut, and rivet proportions, functioning under American Standards Association procedure.

Building Officials' Conference of America. John W. Oehmann, secretary-treasurer, District Building, Washington, D. C. In cooperation with organizations interested in building materials and standard methods of construction, this association assisted in the preparation of specifications for lime, stucco, hollow and solid building units, wall board, and steel joists. It is now cooperating with the building-code committee of the United States Department of Commerce in the formulation of a standard building code covering building regulations. The conference is officially represented on sectional committees on code for building exits; floor and wall openings; brick masonry; elevators, industrial sanitation, and walkway surfaces.

Bureau of Envelope Manufacturers of America. (See Envelope Manufacturers' Association of America, p. 318.)

Bureau of Explosives. Col. B. W. Dunn, chief inspector, 30 Vesey Street, New York, N. Y. This bureau functions as an agency for cooperation between the Interstate Commerce Commission and the American Railway Association. It formulated specifications for shipping containers for the transportation of explosives and other dangerous articles which recently have been revised and issued as I. C. C. reports. It maintains a chemical laboratory for the study of explosives and containers, and a force of traveling inspectors to insure compliance with the requirements of the specifications. The bureau is officially represented on the sectional committee on methods of testing petroleum products and lubricants.

Bureau of Railway Economics. J. H. Parmelee, director, Transportation Building, Washington, D. C. Maintained by the railway companies for the scientific study of transportation problems, this bureau conducts no

original standardization work, but carries on as a fact-finding body in co-operation with the American Railway Association and the various railway committees charged with the specific duty of recommending standardized materials and practices.

California Redwood Association, R. F. Hammett, secretary-manager, 24 California Street, San Francisco, Calif. This association has adopted structural grading rules and specifications of California redwood which conform to American lumber standards and other essential provisions for structural grades as approved by the American Railway Engineering Association and the American Society for Testing Materials, together with working stresses approved by the Forest Products Laboratory of the United States Department of Agriculture. It has also adopted specifications for eastern grades of California redwood lumber and California specifications for structural grades of naturally durable redwood, including standard specifications of the bridge department of the California division of highways relating to bridge timbers and piling. This association has established a department of inspection and grades through which the association supervises the grades of all redwood lumber manufactured by its member mills. Shipments which have been inspected are covered by inspection certificates bearing the official seal and signature of the association. These certificates insure to purchasers that lumber so inspected conforms to the standard grades officially adopted by the association. The association is now actively cooperating with manufacturers of other west coast woods on a program for the standardization of patterns and sizes of moldings.

California White and Sugar Pine Manufacturers Association, B. Scott, acting secretary-manager, Call Building, San Francisco, Calif. Cooperating with the Western Pine Manufacturers Association, this organization has published standard grading rules for pondosa, California sugar and white pine, larch, Douglas fir, white fir, spruce, and cedar lumber. These rules conform to American lumber standards. A corps of traveling inspectors is employed by this association to instruct member organizations in standard grading practices and to check the grades.

Canners League of California, Preston McKinney, vice president, 215 Market Street, San Francisco, Calif.

This organization, composed of fruit and vegetable canners, has for its objects the improvement in quality and grades of fruits, standardization of trade practices, and the general up-building of the industry. It has aided in securing the adoption of a law by the California legislature requiring all canned peaches, pears, apricots, and cherries of a grade below certain approved standards to be marked "Seconds, wholesome fruit unsuited for the better table grades," together with a statement indicating the density of the sirup, or, if the fruit is packed in water, a statement that it is without added sugar. This information must be lithographed on the lid of the can in letters of a specified size. The league has issued a booklet in which are incorporated the standards and specifications relating to California canned fruits. It has standardized the method of determining drained weights for various sizes of fruit cans, and has promulgated standard contract forms for the sale of canned goods, and for the purchase from growers of green fruit and vegetables.

Cast Iron Pipe Research Association, Thomas F. Wolfe, research engineer, 122 South Michigan Avenue, Chicago, Ill. The standardization work of this association relating to cast-iron pipe is confined largely to its activities on sectional committees of the American Standards Association. Work on the standardization of gas joints is being carried on by this association at the American Gas Association laboratory. It maintains a research associate at the National Bureau of Standards investigating the causes of soil corrosion.

Cast Stone Institute, C. G. Walker, assistant secretary, 33 West Grand Avenue, Chicago, Ill. This institute is an organization of cast stone manufacturers formed to improve the quality of cast stone and to disseminate information regarding its use. The institute has inaugurated a campaign for standardizing the physical quality of cast stone, and has also prepared a complete architectural specification governing the handling and setting of the material.

Central Committee on Lumber Standards. (See Chapter VII, p. 277.)

Certified Milk Producers Association of America (Inc.), Harris Moak, secretary, 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, J. K. Holbrook, jr., secretary, 67 Wall Street, New York, N. Y. An important accomplishment of this institute has been the reduction in the number of sizes of chain. In cooperation with chain manufacturers, the committee on simplified specifications, which was appointed by the institute several years ago, submitted recommendations for the elimination of numerous items relating to various kinds of chain from manufacturers' catalogues. These recommendations resulted in the formulation and adoption of the simplified-practice recommendation for welded chains. The institute's committee is still active in endeavoring to bring about a further reduction of chains.

Chamber of Commerce of the United States of America, E. W. McCullough, manager, department of manufacture; **Philip P. Gott,** manager, trade association department, Washington, D. C. During the nine years of its existence this department has cooperated with the United States Department of Commerce in the elimination of waste in industry through simplification and standardization. It has acted in a liaison capacity in bringing together trade groups representing numerous industries with agencies of the Federal Government to work out programs for standardization and simplification of commodities. The department took an active part in the movement which resulted in the formulation of simplified-practice recommendations relating to warehouse forms, and range boilers and expansion tanks. The trade association department of the chamber maintains contact with over 1,000 trade associations, acquainting them with the constructive work which may be carried on as part of their organization programs in standardization, simplification, and technical and scientific research. Items relative to such activities are carried by this department in its News Letter which is published monthly. In 1930 the trade association department initiated a study of trade-promotion activities by trade associations which included, among other things, technical or scientific research. The chamber of commerce is officially represented on the planning committee which acts in advisory capacity to the division of simplified practice.

Chlorine Institute, Robert T. Baldwin, secretary, 30 East Forty-second

Street, New York, N. Y. A standard specification for liquid chlorine was formulated by this institute in cooperation with the War Department. It has also prepared and adopted specifications and drawings for standard valves for 100, 105, and 150 pound, and 1-ton chlorine containers. The institute is now working in the establishment of container procedure at liquefaction plants (inspection of transportation containers, etc.), standard method for the determination of hydrogen in loaded tank cars, and code of practices governing the handling of liquefied chlorine gas containers of multiple-unit tank cars.

Clay Products Association, George C. D. Lenth, secretary and consulting engineer, 111 West Washington Street, Chicago, Ill. Manufacturers of vitrified-salt glazed-clay sewer pipe, drain-tile, wall coping, segmental block, and flue lining comprise the membership of this association. Its work in the establishment of standards and specifications is carried on by several committees, including the committee on standardization which works in harmony with the National Bureau of Standards in matters of research and testing. It is a member of the American Society for Testing Materials, and has adopted the latter's specifications for clay sewer-pipe and drain-tile. The association is at present conducting cooperative investigation of sewer-pipe joints at the University of Illinois, where it maintains a cooperative research fellowship, the efforts of which at this time are directed toward the processes of manufacturing vitrified clay products, wall coping, and flue lining. It also carries on another line of research at the Iowa State College on the effect of wide trenches and V-shaped trenches on trench loads.

Coal Mining Institute of America, W. E. Fohl, consulting engineer, Pittsburgh, Pa. This organization takes an active part in the mining standardization work going forward under the auspices of the American Standards Association. It is a member of the mining standardization correlating committee, and is officially represented on other sectional committees of the A. S. A. dealing with coal mining projects.

Commission on Standardization of Biological Stains, H. J. Conn, chairman, Agricultural Experiment Station, Geneva, N. Y. The commission is a cooperative organization affiliated with the National Research Council and offi-

cially connected with several scientific societies, the representatives of which comprise the executive committee of this organization. Its objects are to improve the quality and to increase the reliability of the biological stains on the market; also to stimulate research concerning stains and their biological uses. The commission does not manufacture or sell stains, but co-operates with the manufacturers. The manufacturers are urged to submit a sample of each batch of any stain to the commission for testing before it is put on the market. Any batch thus tested and found satisfactory may then be sold by stain dealers under the commission certification issued in the form of labels and attached to bottles containing stains. At present nearly 50 stains have been tested and put on the certification basis by the commission. Under the direction of the chairman, the commission has issued a revised edition of a handbook on biological stains containing discussion relative to about 20 dyes not covered in the first edition, and also gives in detail about 75 of the most important staining formulas and procedures calling for stains.

Common Brick Manufacturers' Association of America, Ralph P. Stoddard, secretary-manager, Guarantee Title Building, Cleveland, Ohio. In cooperation with the American Face Brick Association, this organization sponsored the movement for a simplification of brick sizes conducted under the auspices of the division of simplified practice of the National Bureau of Standards, which resulted in the formulation and adoption of the simplified practice recommendation relating to face brick and common brick. It also cooperated in the initiation of the work of the building code committee of the United States Department of Commerce. During the past year this association prepared specification for brickwork and other essential data for the use of architects, engineers, and builders. It maintains a research associate and an assistant at the National Bureau of Standards investigating the physical properties of the various grades of brick and types of brick masonry. It is also investigating the physical properties of brick masonry at other laboratories and in the field. The association is assisting the industry in the application of the certification plan to the Federal specification for common-clay brick. It maintains representation on the sectional committee on the development of a code of

good practice in brick masonry functioning under the rules of procedure of the American Standards Association.

Compressed Air Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. During the past year this association issued a fourth edition of its pamphlet entitled "Trade Standards" which embodies the result of extended study and research on the part of the executives and engineers associated with the companies that are members of the society. This publication embraces the accepted nomenclature and terminology relating to air compressors, and their operation, with appropriate definitions; explanation of capacities and pressures; a description of the low-pressure nozzle test recommended by the society; instructions for the installation and care of air compressors and recommendations for their lubrication; lists of standard sizes of air receivers; pneumatic tool standards; and other information of value. The society is officially represented on the sectional committees on safety code for compressed-air machinery, frame dimensions of electric motors, and standardization of speeds of machinery.

Compressed Gas Manufacturers' Association (Inc.), Franklin R. Fetherston, secretary, 110 West Fortieth Street, New York, N. Y. Numerous committees conduct the standardization work of this association, the recommendations of which are submitted to the test and specification committee for review. The latter committee has taken an 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. The valve thread standardization committee has been engaged in selecting suitable standards of design and thread for cylinder valve outlets and has submitted recommendations regarding the adoption of certain standards. It has formulated rules for safe handling and use of compressed gas cylinders and a schedule of recommended safety devices for use on compressed gas containers; also tentative regulations and specifications for the installation and operation of liquefied petroleum for storage containers and appurtenant apparatus. Many standards for use in the compressed gas industries are developed as association standards.

Concrete Products Association, F. O. Matthiessen, executive secretary, 644 Drexel Building, Philadelphia, Pa. In cooperation with the Portland Cement Association, this organization assisted in the establishment of the simplified practice recommendation relating to concrete building units. It issues certificates of quality to its members when it is found that their products meet the requirements of the American Concrete Institute standards. Before a certificate of quality is given to a member, his product is tested by a representative of the association to determine whether or not it meets the requirements. The certificate is good for the balance of the membership year, and renewals can be obtained only after tests are made of new specimens.

Concrete Reinforcing Steel Institute, M. A. Beeman, secretary, Tribune Tower, Chicago, Ill. This institute was organized to carry on promotional and research work and to standardize materials used in reinforced concrete construction. One of its important accomplishments has been the establishment of a simplified list of sizes of steel reinforcing bars and spiral rods and the formulation of standards for the various grades of steel. This movement was sponsored by the institute and resulted in the adoption of the simplified practice recommendation relating to these commodities. The institute has adopted standard weights for billing bars sold on theoretical weights, thereby enabling all its members to bill on the same basis. It is now engaged in the formulation of two or more standard types of deformed bars, replacing many different standards now in use which will assist rolling mills to decrease the cost of manufacture with a resulting benefit in savings to the members of the institute. In cooperation with the American Concrete Institute this organization adopted a joint building code allowing economical concrete design which has become the standard for reinforced concrete throughout the industry. This code has already been adopted or permitted by special ruling in many cities and is being extended to include several other larger cities of the country. A special committee has devoted months of study to a proposed quality mark for certified new billet steel. This quality mark, rolled into each bar, will assist the institute members to distinguish quality steel from foreign-made

bars and domestic steel of questionable quality and grade. It has also in the course of preparation a form of licensing agreement which will permit its members to use the quality certification trade-mark on steel which measures up to the required standards of grade and quality. In order to make the quality trade-mark effective, the institute is inaugurating a campaign to educate the users of reinforced steel to insist on quality-marked bars in their purchase specifications. In the development of standards and specifications for use in the reinforcing concrete industry the institute is actively cooperating with the American Concrete Institute, American Society for Testing Materials, Portland Cement Association, and other technical societies. It has issued several publications dealing with reinforced concrete building design, a bar card showing standard weights for bars, and other literature as effective media for promotional work. It has now in course of preparation other publications relating to designs for tall buildings, quality marking of reinforced steel, and fireproof-construction buildings.

Consolidated Freight Classification Committee, R. C. Fyfe, chairman, 404 Chicago Union Station, Chicago, Ill. "Consolidated Freight Classification" is the title of a publication dealing with ratings, rules, and regulations concerning freight classifications and carrier charges which has been published under the direction of the chairmen of the official, southern, and western classifications committees. Specifications for freight-shipping containers and the marking and packing of freight are also included among the rules and regulations.

Contracting Plasterers' International Association, Edward McDonnell, secretary-treasurer, 4755 Commonwealth Avenue, Detroit, Mich. Several committees appointed by the president carry on the association's work in standardization. It has adopted a standard specification for lathing and plastering work, and also a proposed outline specification for lathing and plastering intended to serve as a guide for architects and others in the preparation of their specifications for individual building projects. The association is officially represented on the sectional committee on specifications for plastering.

Converters' Association. (See Textile Converters' Association, p. 359.)

Copper and Brass Research Association, W. A. Willis, manager, 25 Broadway, New York, N. Y. This association does not concern itself directly with standardization matters, but does cooperate by representation on committees of the American Society of Civil Engineers, American Society of Mechanical Engineers, American Society for Testing Materials, American Institute of Electrical Engineers, American Standards Association, and other organizations interested in the formulation and adoption of standards and specifications. The association maintains a research associate at the National Bureau of Standards investigating the corrosion of roofing metals.

Cordage Institute, J. S. McDaniel, secretary, 350 Madison Avenue, New York, N. Y. This organization assisted in the revision of the Federal specification for manila rope, and cooperated with the National Paper Trade Association in formulating the simplified practice recommendation for hard-fiber ply and yarn goods. One of the institute's committees is working with the American Petroleum Institute in preparing standards for cordage used in oil-well production, while another committee is carrying on work with the American Society for Testing Materials in the standardization of methods of tensile-strength testing and nomenclature of all hard-fiber products.

Cotton-Textile Institute (Inc.), C. K. Everett, in charge, new uses section, 320 Broadway, New York, N. Y. The institute's work in simplification and standardization is carried on in cooperation with large cloth and yarn consumer organizations and other bodies. The institute has taken over the activities of the National Council of American Cotton Manufacturers. In its work on standards and specifications, it cooperates with the Federal Specifications Board in the formulation and promulgation of Federal specifications for cotton textile commodities. It has prepared specifications for numerous cotton cloths, both in the gray and dyed, which are used in the rubberizing and coating trades. These specifications were prepared in cooperation with the standards committee of the Rubber Manufacturers Association and have now been adopted as standard. The institute has cooperated with the National Tent and Awning Manufacturers Association and with individual tarpaulin manufacturers in formulating a new proposed standard for marking all water-

proofed cotton fabrics for tents and tarpaulins to show the original gray goods weight on a square-yard basis, in place of the present practice of marking and identifying these goods by finished weight. It also cooperated with the National Tent and Awning Manufacturers Association in the preparation of a pamphlet setting forth standard definition of terms relating to cotton fabrics in the awning, tent, and tarpaulin trade. It has adopted standard codes of trade practice for the guidance of the flat duck and carded yarn groups. Recently the institute completed a survey for narrow sheetings manufacturers and selling agents interested in developing the use of cotton fabrics for retail packaging of citrus fruits and vegetables. The purpose of this survey is to promote the various uses of cotton bags and bagging fabrics for retail packaging. It also cooperated in the establishment of the commercial standard for regain of mercerized cotton yarns and in the formulation of the simplified practice recommendation relating to standard sizes of hospital and institutional cotton textiles. The institute has participated in discussions relative to the preparation of standards to assist the consumer in purchases of cotton bed sheets and blankets held under the auspices of the American Standards Association. The institute is represented on the standing committee on the simplification of hospital and institutional cotton textiles as well as on another dealing with the standardization and simplification of buffing and polishing wheels.

Cover Paper Manufacturers Association, E. H. Naylor, secretary, 44 Vernon Street, Springfield, Mass. Specific trade practices relating to cover paper are sponsored by this association. Included in these trade practices are matters concerning standard sizes and weights.

Crown Manufacturers Association of America, Louis B. Montfort, executive secretary, Munsey Building, Washington, D. C. In cooperation with the division of simplified practice of the National Bureau of Standards the Glass Container Association of America, the American Bottlers of Carbonated Beverages, and other interested bodies this association effected a standardization of bottle labeling in that the contents clause is blown plain and conspicuously in the side of the bottle. The association is now assisting its member manufacturers in developing a crown labeling

program for standard stock crowns which will conform to the requirements of Federal and State pure food and drug enforcement laws and regulations. It is now collaborating with proprietary drink manufacturers who use crown labels carrying brand names to standardize on the types of labeling for synthetic flavored beverages, pure-fruit flavored beverages, and those which are flavored with the oils derived from fruits.

Dairy and Ice Cream Machinery and Supplies Association (Inc.), Roberts Everett, secretary-manager, 225 West Thirty-fourth Street, New York, N. Y. This association has no standardization committee of its own. It does, however, through several groups of its membership, take an active part in such standardization movements as affect their products. It participated in the activities of the International Association of Ice Cream Manufacturers in the standardization of ice cream cans, and is now cooperating in the establishment of a simplified practice recommendation for ice cream molds and cartons.

Diamond Core Drill Manufacturers' Association, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. In cooperation with manufacturers, drilling contractors, and others, this association assisted the division of trade standards of the National Bureau of Standards in the establishment of a commercial standard relating to diamond core drill fittings. The aim of the new standards is to make diamond core drill fittings, such as bits, casing and rods, as produced by the various manufacturers, interchangeable in the field, in so far as controlling diameters, threads, and dimensions of joints are concerned. To insure that the fittings actually are interchangeable, the manufacturers have adopted a carefully controlled system of gaging, made effective by means of working gages in constant use in the various plants as a guide to satisfactory production. As a further safeguard to the user and in order that he may know that the fittings he requires conform to the new standards, the working gages can be procured only through the association which has adopted an emblem to be attached to products made in conformity with the new standards, or on packages or cartons containing standard goods. These emblems are supplied only to manufacturers who have purchased the necessary gages for producing the new standard diamond core drill fittings.

Diesel Engine Manufacturers' Association, M. J. Reed, research engineer, 30 Church Street, New York, N. Y. Practically all of the standardization activities of this association are carried forward in cooperation with other interested organizations. It is cooperating with the American Society of Mechanical Engineers, the American Society for Testing Materials, and the American Standards Association in the formulation of tentative standards for Diesel fuel oil. It is also cooperating with the National Electrical Manufacturers' Association in standardizing electric generator sizes and speeds. It has issued a booklet in which are embodied the results of considerable study on the part of executives and engineers associated with companies actively engaged in the manufacture of Diesel engines. This booklet contains several chapters dealing with standard principles of business, standard practices, notes on the selection and installation of stationary Diesel engines, and standard definitions. It is officially represented on the sectional committee on specifications for pressure and vacuum gages.

Drill and Reamer Society, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. Having eliminated from catalogue lists the obsolete types of drills and reamers, this organization is now engaged, through its standing committee on simplification and standardization, in listing standard drills and reamers in revised catalogues.

Eastern Clay Products Association, Henry T. Shelley, secretary-manager, Colonial Building, Philadelphia, Pa. Several committees, including the standards committee, carry on the association's work in standardization. This association has adopted the American Society for Testing Materials' specifications for clay sewer pipe and drain tile. It holds membership in the American Society for Municipal Improvements, American Society of Sanitary Engineering, Association of Highway Officials of the North Atlantic States, the American Society for Testing Materials, and other organizations. It has a staff of trained engineers for the purpose of promoting and servicing the better and more extended use of vitrified clay sewer pipe and other clay products.

Eastern States Blast Furnace and Coke Oven Association, D. A. Russell, chairman, coke testing committee, care of Youngstown Sheet & Tube Co., Youngstown, Ohio. The standardiza-

tion of methods used for coke testing, so that all plants can compare the results of their work, is conducted by the coke testing committee of this association. The association has prepared a booklet containing five standard methods for physical tests of coke and two standard methods for physical tests of coal. These methods conform with those adopted by the American Society for Testing Materials. The association is now actively engaged in the standardization of large size tumbler for coke and the preparation of methods of coke sampling.

Eastern Supply Association, Frank S. Hanley, secretary, 261 Broadway, New York, N. Y. This association, composed of plumbing and heating manufacturers and wholesalers, cooperated in the formulation of many simplified practice recommendations, as follows: Range boilers; brass lavatory and sink traps; hot-water storage tanks; staple vitreous china plumbing fixtures; wrought-iron and wrought-steel pipe, valves, and fittings; staple porcelain plumbing fixtures; and standard weight malleable iron or steel screwed unions. It cooperated in establishing commercial standards for genuine wrought-iron and steel pipe nipples.

Electric Hoist Manufacturers Association, E. Donald Tolles, secretary, 165 Broadway, New York, N. Y. In cooperation with the American Institute of Electrical Engineers, the American Society for Testing Materials, and the National Electrical Manufacturers' Association, standard specifications covering portable overhead hoists were formulated and approved by this organization.

Electric Steel Founders' Research Group, R. A. Bull, director, 541 Diversey Parkway, Chicago, Ill. Since this group was organized in 1920, it has been engaged in cooperative research work, on improved and standardized methods for the manufacture of small and medium-sized castings of carbon and alloy steels. The group cooperated officially in the formulation of the simplified practice recommendations relating to malleable foundry refractories, and has adopted its own uniform inspection standards governing the manufacture of group company products. Representatives of the group participate as members of various committees of technical societies in standardization activities relating to steel castings and to materials used in their manufacture.

Elevator Manufacturers' Association of the United States, John W. Ogren, commissioner, 100 West Monroe Street, Chicago, Ill. This association maintains permanent committees for standardizing elevator engineering and for studying elevator-traffic problems. The American Standards Association safety code for elevators, dumb-waiters, and escalators has been adopted as its standard.

Employing Bookbinders of America, Raymond E. Baylis, chairman, standardization committee, 28 West Forty-fourth Street, New York, N. Y. This organization cooperated with the Binders Board Manufacturers Association in the formulation of the simplified practice recommendation relating to sizes of binders boards for stock. The association's standardization committee is now cooperating with manufacturers of imitation leather and book cloth in the establishment of standard colors, grades, and widths of these items.

Envelope Manufacturers' Association of America, Charles R. Stevenson, secretary-treasurer, 19 West Forty-fourth Street, New York, N. Y. Established standards covering grade of paper, nomenclature, sizes of envelopes, and tolerances for overruns and underruns on customers' orders have been adopted by this association.

Feldspar Grinders' Institute, B. C. Burgess, chairman, committee of standardization, care of Tennessee Mineral Products Corporation, Spruce Pine, N. C. At the first meeting of this institute in 1929, a committee was appointed to consider the standardization of feldspar in the industry. This committee formulated recommendations which were submitted to the institute for approval and adoption. In cooperation with the division of trade standards of the National Bureau of Standards these recommendations were officially acted upon, resulting in the establishment of the commercial standard relating to grades of feldspar which have been approved and adopted by the industry.

Felt Manufacturers Association, M. J. Morrison, secretary-treasurer, 17 Battery Place, New York, N. Y. Six grades of rags, including requirements and quality of materials, are set forth in a standard classification of rag stock formulated by this organization.

Food Service Equipment Association, Allen Bennett Forsberg, managing director, 10 South La Salle Street,

Chicago, Ill. The president of this association appointed a national committee on standardization and simplification, composed of a chairman and 18 representatives from the different local clubs of the association, to conduct a survey of the industry in co-operation with the restaurant, hotel, hospital, and utensil associations. The association is also enlisting the services of the National Bureau of Standards in formulating standards, specifications, and simplifications of metal weight, gages, and other items.

Forging Manufacturers Association, George H. Weiler, secretary-manager, Grand Central Terminal, New York, N. Y. This association has not adopted any standard specifications. It does maintain a specification committee engaged in standardization work within the industry. This committee also deals with the interpretation of various specifications which have been established by users of materials, and cooperates with industries in setting up standard designs or specifications best suited to meet particular conditions or requirements of work.

Gas Products Association, C. T. Price, secretary, 608 South Dearborn Street, Chicago, Ill. Much of the work in standardization of this association is carried on by a committee which is now engaged in defining existing threads used upon oxygen and acetylene cylinder valve outlet connections. This association cooperated with the International Acetylene Association in the formulation of specifications covering hose connections for welding and cutting torches.

Glass Container Association of America, W. L. Davis, secretary of the standardization committee, 19 West Forty-fourth Street, New York, N. Y. The standardization committee of this association representing a membership group of cap and closure and glass manufacturers has formulated 52 standards covering the various types of glass finishes used on the present-day glass container. In collaboration with the National Cap Manufacturers Association and the International Association of Milk Dealers, this association assisted in the formulation of the simplified practice recommendation relating to milk and cream bottles and bottle caps. During the past year several of the existing standards have been clarified and improved, and four new types of glass finishes have been standardized.

The committee is actively cooperating with similar committees of the American Bottlers of Carbonated Beverages, American Pharmaceutical Association, and the National Preservers' Association and with the division of simplified practice of the National Bureau of Standards in the establishment of simplified practice recommendations for preserve jars, drug and pharmaceutical bottles, carbonated beverage bottles, and cottage cheese jars.

Glycerine Producers' Association, Roscoe C. Edlund, manager, 45 East Seventeenth Street, New York, N. Y. This organization is one of the parts of the Association of American Soap and Glycerine Producers. All of its standardization activities are conducted by a glycerine research committee, composed of chemists selected from member companies. This committee cooperates with the National Bureau of Standards in the establishment of standard grades of refined glycerine and with the Federal Specifications Board in the promulgation of Federal specifications covering all grades of refined glycerine. The association's laboratories make tests of radiator glycerine bought in the open market to determine whether or not it complies with the association's formula in order to assure the public a good grade and quality of glycerine. Those members of the association who produce radiator glycerine in accordance with the formula are permitted to market 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 anti-freeze use in automobiles. In addition, the members are also permitted to use the association's seal on containers bearing the liquid.

Grain and Feed Dealers National Association, Charles Quinn, secretary, 321 Gardner Building, Toledo, Ohio. During the past year this association has taken over the activities of the United States Feed Distributors Association, and its name was changed from the Grain Dealers National Association to the above. This association has adopted as its standard grades of grain those which have been prepared by the United States Department of Agriculture in accordance with the grain standards act, passed by Congress in 1916. It has also adopted trade rules which are designed to govern transactions in feedstuffs between the direct and affiliated members of

the association, and also arbitration rules for the purpose of settling disputes which arise among its members relating to the sale of grain and feed. The association has also adopted a confirmation blank in order to bring about uniformity in the confirmation of trades or transactions among members and to simplify these trades as much as possible so as to prevent misunderstandings.

Gray Iron Institute (Inc.), Arthur J. Tuscany, manager, Terminal Tower Building, Cleveland, Ohio. This institute is a cooperative organization whose function is to safeguard and promote the interests of the gray-iron foundry industry both in the United States and Canada. It has adopted certain standard sales agreements, trade customs, and sales contract forms promulgated by the California State Chamber of Commerce. Through the work of its research committee and certain staff members, the institute is now engaged in the preparation of a set of standard recommended practices for every type of gray-iron casting used in the industry.

Grinding Wheel Manufacturers Association of the United States and Canada, Frank R. Henry, secretary, Dayton, Ohio. Standards and specifications prepared and adopted by this association include those for abrasive grain sizes for grinding wheels and polishing wheels, steel centers as used for coping wheels, and size and specifications for compression blotters or posters as applied to grinding wheels. During the past year the committee on simplified practice and elimination of waste cooperated in revising the simplified practice recommendation relating to standard shapes of grinding wheels and attachments. The association is joint sponsor with the International Association of Industrial Accident Boards and Commissions for the sectional committee on safety code for abrasive wheels. This code has been approved by the American Standards Association as an American standard.

Gypsum Association, H. J. Schweim, acting secretary, 211 West Wacker Drive, Chicago, Ill. The association, successor to the Gypsum Institute, conducts its standardization work in cooperation with committees of the American Society for Testing Materials. The association has adopted the following standard specifications relating to gypsum products prepared by the A. S. T. M.: Gypsum, plasters, plastering sand, wall board, plaster

board, partition tile or block, molding plaster, pottery plaster, Keene's cement, and calcined gypsum for use in the preparation of dental plaster. It has also adopted the standard methods for testing gypsum and gypsum products. The association also cooperated in the initiation of the work of the Building Code Committee of the United States Department of Commerce on the section of the code relating to gypsum. All gypsum products manufactured by the members of this association are made to comply with the requirements of the A. S. T. M. standard specifications for that particular product. The association is officially represented on the sectional committees on fire tests of building construction and materials and on specifications for plastering, functioning under the rules of procedure of the American Standards Association.

Hack Saw Manufacturers Association of America (Inc.), W. P. Jeffery, managing director, 14 Wall Street, New York, N. Y. This organization has been instrumental in the formulation of the simplified practice recommendation relating to standard sizes of tungsten blades and high-speed blades. This recommendation has been unanimously accepted by the industry.

Hardwood Interior Trim Manufacturers Association, J. W. McClure, acting secretary, 63 South Third Street, Memphis, Tenn. The rules and regulations promulgated by this association relate to standard grades for hardwood interior trim and molding. The association has adopted the American standard designs and sizes of wood moldings prepared under the auspices of the Central Committee on Lumber Standards. This association is officially represented on the sectional committee on safety code for woodworking plants.

Hardwood Manufacturers Institute, J. H. Townshend, executive vice president, Bank of Commerce Building, Memphis, Tenn. The grading rules for hardwood lumber, cypress, veneers, thin lumber, and plywood instituted by the National Hardwood Lumber Association have been adopted by this organization. Based on a series of tests conducted by the Forest Products Laboratory of the United States Department of Agriculture, the institute has established a standard of estimated weights of hardwoods of given thickness and moisture content. The institute has inaugurated a "car

card plan" in accordance with which it issues licenses to lumber mills which guarantee the contents of sealed cars 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. The standardization of pipe flanges and fittings is sponsored by this association in cooperation with other interested organizations under American Standards Association procedure. Among its many other activities in the standardizing field are the following: Method of estimating radiation, selecting boilers, and installing proper sizes of pipe; dimensions of welding neck flanges for standard pipe, and extra heavy welding neck flanges for standard or extra heavy pipe; establishing commercial standards for genuine wrought-iron pipe nipples and for standard-weight malleable iron or steel screwed unions; eliminating steam-pipe radiators and surplus pipe sizes, and simplifying hack-saw blades; and developing a national program for certified heating, thereby giving assurance that all such certified plants are properly designed and installed. This association has compiled and published data on computing heat losses, the selection of boilers, and sizing pipes for steam-heating systems. It is now preparing a pipe-welding manual. Standardizing pipe sizes for hot-water systems is one of its recent projects.

Hickory Handle Association, Guy E. Basye, secretary, care of W. E. Bruner and Sons, Heber Springs, Ark. Under the auspices of the division of simplified practice of the National Bureau of Standards, this association, in cooperation with the National Association of Wood Turners with which it is affiliated, was instrumental in the formulation of the simplified practice recommendation relating to grading of hickory handles.

Hollow Metal Manufacturers' Association, Charles F. Burt, executive director, Chanin Building, New York, N. Y. In cooperation with other interested organizations this association is standardizing metal doors and trim, symbols and schedules therefor, and template hardware. It has completed the standardization of builders' template hardware for cylinder locks and allied items, and for template butts, this work being carried out in cooperation with the division of trade standards of the National Bureau of Stand-

ards. Under the auspices of the division of simplified practice it initiated the movement that finds expression in the simplified practice recommendations for hollow metal doors and for kalamein doors.

Horological Institute of America, Paul Moore, secretary, care National Research Council, Washington, D. C. This institute was organized by the National Research Council. Its purpose is to establish standards for horological schools. It grades watchmakers, giving examinations in both the theory and practice of repair work. Those who pass its requirements are given certificates.

Hydraulic Society, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. Since its organization in 1917, this society has functioned as the representative trade organization of the pump industry. It cooperates with the Chamber of Commerce of the United States of America, the American Society of Mechanical Engineers, American Mining Congress, the National Fire Protection Association, the United States Department of Commerce, and other trade bodies in a discussion of problems affecting the pump industry. This society has adopted standard definitions and values; test codes; classification of pumps; and instructions for installing and operating the displacement, centrifugal, rotary, and deep-well types of pumps. These standards are set forth in a publication, the fifth edition of which has already been issued by the society. It is officially represented on the sectional committees on pipe flanges and fittings; code for pressure piping; frame dimensions of electric motors; and recommended practice for drainage of coal mines.

Illuminating Engineering Society, E. H. Hobbie, general secretary, 29 West Thirty-ninth Street, New York, N. Y. Specifications for residence-lighting luminaires are being sponsored by both this society and the Association of Edison Illuminating Companies. A sectional committee is revising the lighting code for factories, mills, and other work places. Another committee of the society is revising illuminating engineering nomenclature and photometric standards. These will be submitted to the American Standards Association. Other projects for which the society is serving as joint sponsor are those relating to the code of lighting school buildings (with the American Institute of Architects); automobile headlight

specifications (with the Society of Automotive Engineers); and other sectional committee work.

Industrial Truck Association, C. B. Crockett, secretary, 60 East Forty-second Street, New York, N. Y. This association took an active part in the formulation of the simplified practice recommendation for 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 order to establish a standard method of testing and rating fan-unit heaters for steam as a heating medium, representatives of this association and the American Society of Heating and Ventilating Engineers formed a joint code committee for the purpose of preparing a standard code. This code, known as "Standard Code for Testing and Rating Steam Unit Heaters," was approved and adopted by both organizations and published during the year.

Institute of American Meat Packers, W. W. Woods, president, 506 South Wabash Avenue, Chicago, Ill. The work of standardizing equipment, supplies, and packs of this institute is supervised by a committee on standardization. The committee receives any proposals members may care to make regarding equipment, supplies, or packs which it is considered advisable to standardize. If the committee believes a proposed project is feasible, it first obtains the views of each of its members as to what standards should be recommended. Technical advice is also obtained from leading manufacturers. A questionnaire is then sent to the institute members indicating the new standards recommended by the committee. If a majority of the replies to the questionnaire returned indicate acceptances, the proposed standards are recommended for adoption. Standards for the following packing-house supplies, packs, and equipment have been adopted by the institute: For supplies—lard cans; ropes and twines; brushes; cheesecloth and muslin; sausage, lard, and sliced bacon cartons; woodenware and cooperage; paper (including standard sizes for wrapping smoked meats); boxes and crates (detailed specifications); and nailed wooden boxes and crates (general specifications); for packs—lard: sausage; and sliced bacon; for equipment—hand trucks and beef and pork trolleys. At the present time the committee is engaged in developing stand-

ards for vinegar-pickled products packed in glass jars. It is also cooperating with the division of simplified practice of the National Bureau of Standards and with the Associated Cooperage Industries of America in the development of standards for cooperage. Changes in merchandising methods have influenced the committee on standardization to recommend increasing the number of standard packs for lard and shortening by the following weights: $1\frac{1}{2}$, 3, and 6 pounds. There was also recommended an additional standard of 16-pound weight for shortening only. The standards for 65-pound tubs have been changed to make the use of handles optional. The standards for twine for tying paper-wrapped smoked meats have also been revised as regards the number of feet to the pound and as to the number of pounds for tensile strength. The institute is officially represented on the sectional committee on the standardization of speeds of machinery functioning under the rule of procedure of the American Standards Association.

Institute of Boiler and Radiator Manufacturers, F. W. Herendeen, secretary, Geneva, N. Y. This organization, formerly known as the National Boiler and Radiator Manufacturers' Association, is composed of manufacturers of low-pressure cast-iron boilers and radiators for heating purposes. The standardization work of the institute is carried on by a technical committee, the members of which are selected by the chairman. This committee formulated the steam heating boiler testing code for solid-fuel burning low-pressure steam boilers which was approved and adopted by the institute. In cooperation with the committee on construction of buildings of the National Board of Fire Underwriters, the institute cooperated in the preparation of a standard ordinance for chimney construction suitable for use in cities and towns or as a model for a State law. The institute is officially represented on the boiler code committee of the American Society of Mechanical Engineers and on the sectional committee dealing with standard dimensions for pipe threads.

Institute of Makers of Explosives, C. Stewart Comeaux, secretary, 103 Park Avenue, New York, N. Y. Formulation of standard recommended sizes of cartridges and strengths of high explosives is one of the chief functions of this institute. It is officially represented on the sectional

committee on recommended practice for the use of explosives in bituminous coal mines.

Institute of Paint and Varnish Research, Henry A. Gardner, director of laboratory, 2201 New York Avenue NW., Washington, D. C. Working in harmony with the National Bureau of Standards on paint and varnish research, with the Federal Specifications Board in preparing specifications on these commodities, and conducting original research work for the American Paint and Varnish Manufacturers Association are the main activities of this organization.

Institute of Radio Engineers, Harold P. Westman, secretary, 33 West Thirty-ninth Street, New York, N. Y. This institute, which numbers among its membership nearly all of the men who have become prominent in the development of radio in the United States, as well as many noted radio engineers and scientists in other countries, has been active since its organization in 1912 in standardizing radio terms, symbols, and nomenclature. The committee on standardization, which is under the supervision of the board of directors of the institute, is engaged at the present time in considering reports of the four technical committees which have prepared tentative standards on radio receivers and parts, transmitters and antennas, vacuum tubes, and electroacoustic devices. The institute has prepared and is now revising several bulletins relating to standard graphical symbols used in radio communication; provisions for safety of operating personnel in relation to radio transmitting equipment; vacuum-tube base standards; and standard tests of broadcast radio receivers. The institute is one of the member bodies of the American Standards Association. It is represented on the radio advisory committee of the National Bureau of Standards and on the council of the American Association for the Advancement of Science and Associated Societies. It is joint sponsor with the American Institute of Electrical Engineers for the sectional committee on radio, and is officially represented on five other sectional committees dealing with the following projects: Specifications for dry cells and batteries, definitions of electrical terms, scientific and engineering symbols and abbreviations, standards for drawings and drafting room practice, and table of preferred numbers.

Insulated Power Cable Engineers Association, H. G. Burd, secretary, care of Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. The membership of this association is composed entirely of engineers employed by power cable manufacturers. It was organized to prepare specifications, conduct research, and to discuss technical engineering problems of common interest. The association has formulated and adopted specifications for varnished cambric insulated wires and cables, and in cooperation with the Association of Edison Illuminating Companies it has assisted in the preparation of paper cable specifications. It is now engaged in a cooperative research program to determine losses in large conductor cables. The association acts as an advisory committee to the power cable division of the National Electrical Manufacturers Association and through this channel it cooperates in the work of committees of the American Standards Association and other national standardizing bodies.

International Acetylene Association, A. C. Morrison, secretary-treasurer, 30 East Forty-second Street, New York, N. Y. In promulgating standards for the industry, this association cooperates with the Underwriters' Laboratories in matters of construction of acetylene generators, blowpipes, and regulators, and with the National Board of Fire Underwriters and the National Fire Protection Association as regards standards for the installation and operation of acetylene equipment. In the construction of cylinders used in the transportation of acetylene gas, this association adopts the shipping container specifications of the Interstate Commerce Commission. It has issued a set of standards for hose connections on gas regulators and blowpipes or torches, and has recently appointed a committee to prepare standards for connections for hose sizes in excess of three-eighths inch. At the present time, the association is collaborating with the Compressed Gas Manufacturers Association in the formulation of standards for threading of valves used in cylinders for storing compressed gases. The association is officially represented on three sectional committees on identification of piping systems, methods of rating rivers, and safety code for mechanical refrigeration.

International Apple Association, R. G. Phillips, secretary, 1108 Mercantile Building, Rochester, N. Y. At the request of dealers of fresh fruits and vegetables, this association formulated and adopted standard rules and definitions of trade terms for the fruit and vegetable industry which have been approved and also adopted for use by the American Fruit and Vegetable Shippers' Association, Colorado Potato Shippers' Association, Fruit and Vegetable Brokers' Association, Melon Distributors' Association, and the Western Fruit Jobbers Association of America. This association was instrumental in the enactment of several laws affecting the industry. It participated in the passage of the apple-grading law, the United States standard barrel laws for fruits, vegetables, and other dry commodities, and in the enactment of the United States standard container act fixing standards for climax baskets for grapes and other fruits and vegetables. In conjunction with representatives of the Horticultural Society and others, this association was responsible for the drafting of the New York State standard apple-crating law which is now being used as a model for similar laws passed in other States.

International Association of Blue Print and Allied Industries, Glen Edwards, executive secretary, 431 South Dearborn Street, Chicago, Ill. The standardizing of widths, weights, content, and speed of coated blue-print paper has been undertaken by this association. This work has been carried on in cooperation with various departments of the Federal Government. The standardization of the measurement of blue prints is receiving the attention of this association.

International Association of Electrotypers of America, Fred W. Gage, chairman standardization committee, care of Gage Printing Co. (Ltd.), Battle Creek, Mich. Through the work of its standardization committee this association has established certain standards for the electrotyping and printing industries. At its annual convention held in Milwaukee in 1930 the recommendations of the committee relating to thicknesses of unmounted electrotypes (when made for use as "ad plates" or on "patent bases"), curved electrotypes, and shell; angle of bevel on plates to be used on "patent bases"; and formula of electrotyping-backing metal were formally approved and adopted by the association and accepted as standards by the two in-

dustries. The association maintains a research associate at the National Bureau of Standards engaged in making studies of some of the various operations of electrotyping for the purpose of determining the best method for making electrotypes.

International Association of Garment Manufacturers, A. F. Allison, secretary, 395 Broadway, New York, N. Y. This organization represents 17 associations or groups actively engaged in standardization work for the garment industry. It has adopted commercial standards for boys' blouses, shirts, waists, junior shirts, and men's pajamas. It is cooperating with the Federal Specifications Board in the formulation of Federal specifications for measurements for dress and work shirts. It is continuing its work on the standardization of cost methods, pocketing fabrics, cotton thread for factory-made work pants, cutting, sewing, and pressing.

International Association of Ice Cream Manufacturers, Fred Rasmussen, executive secretary, Telegraph Building, Harrisburg, Pa. This association is carrying forward a program of standardization of equipment through its simplified practice committee. It has adopted specifications for standard ice cream cans of the 5, 2½, and 1 gallon size (high, low, or squat types) which have been approved by the National Conference on Weights and Measures. The simplified practice committee cooperated with similar committees of the International Association of Milk Dealers of the Allied States Creameries Association in the formulation and adoption of standard specifications relating to paper-seal fittings and in the preparation of standard interchangeable sanitary pipe and fittings. The committee is now working on the standardization of ice cream cups, ranging in size from the 5 and 10 cent cups to the quart size. It is also cooperating in the establishment of a simplified practice recommendation for ice cream brick molds and cartons.

International Association of Industrial Accident Boards and Commissions, Ethelbert Stewart, secretary, United States Bureau of Labor Statistics, Washington, D. C. This association initiated, and is cosponsor for, the revision of a code for the standardization of industrial accident statistics. It is joint sponsor for five sectional committees, as follows: Safety code for abrasive wheels (with the Grinding Wheel Manufacturers'

Association of the United States and Canada); safety code for mechanical power transmission apparatus (with the American Society of Mechanical Engineers and the National Bureau of Casualty and Surety Underwriters); safety code for rubber machinery (with the National Safety Council); safety code for woodworking plants (with the National Bureau of Casualty and Surety Underwriters); standardization of methods of recording and compiling accident statistics (with the National Council on Compensation Insurance and the National Safety Council).

International Association of Milk Dealers, R. E. Little, executive secretary, 228 North La Salle Street, Chicago, Ill. Through its committee on standardization of equipment, this association has cooperated with other organizations having a common interest in the standardization of products in the industry. It has adopted standard sanitary pipe and fittings and sanitary thermometer connections for various sizes of pasteurizing vats and glass-lined tanks. The association initiated the movement which resulted in the simplified practice recommendation for milk and cream bottles and bottle caps. In cooperation with milk can manufacturers, the committee has prepared specifications providing for two standard can neck diameters for facilitating the interchange of milk can covers of the various manufacturers. At the present time, the association is cooperating in the establishment of a simplified practice recommendation for standard cottage-cheese jars.

International Association of Municipal Electricians, W. H. Harth, secretary, City Hall, Columbia, S. C. Fourteen committees appointed by this association are engaged in standardization projects relating to construction, equipment, and operation of fire and police telegraph, traffic signals, electrical inspection, light, heat, and power systems. This association has adopted the following specifications: Single-conductor weatherproof-braid rubber-insulated wire; lead-incased steel-taped armored cable for ornamental street lighting systems; weatherproof copper-covered steel wire; underground lead-incased cable; steel-taped armored cable; loom-covered or spiral-woven aerial cable; and single-conductor flameproof-braid rubber-insulated wire. The association is officially represented on the sectional committees on regulations for electric

wiring and apparatus in relation to fire hazard; national electrical safety code; code for protection against lightning; and code for electricity meters.

International City Managers' Association, Clarence E. Ridley, executive secretary, 923 East Sixtieth Street, Chicago, Ill. This association maintains representation on a joint committee known as the National Committee on Municipal Reporting which prepares standard specifications for municipal reports. Other organizations cooperating in this project are the National Municipal League, the Governmental Research Association, and the American Municipal Association. The association is conducting a research program in the field of measurement standards for governmental services. The principal project on which it is at present engaged is that of municipal sanitation, including street cleaning, snow removal, and refuse removal and disposal. A tentative report dealing with these subjects and entitled "The Measurement and Control of Municipal Sanitation" has been prepared and published by this association. It is officially represented on the sectional committees on cotton rubber-lined fire hose and safety code for grand stands. It also maintains representation on a joint committee which cooperated with the American Standards Association in the standardization of street signs, signals, and markings.

International Society of Master Painters and Decorators (Inc.), E. J. Bush, secretary-treasurer, 127 North Jefferson Avenue, Peoria, Ill. The society cooperates with other organizations in all matters of standards which may be of interest to its members. It has adopted certain standard colors and color folders corresponding thereto. In order to eliminate the differences of opinion regarding colors and shades as designated by name, the society has adopted a numbering system which makes it possible to designate definitely which color is desired. The society cooperated in the establishment of the commercial standard for grades and color of wallpaper.

Ladder Manufacturers Association of America, J. C. A. Leppelman, president, care of Consolidated Pump & Ladder Co., 1608 Tracy Street, East Toledo, Ohio. This association was officially represented on the sectional committee on safety code for ladders which was approved as American standard by the American Standards

Association and adopted by this association. It permits its licensed member manufacturers to use the association's label on all ladders which have been inspected and found to comply with the requirements of the code from the point of view of safety.

Laundryowners National Association of the United States and Canada, W. E. Fitch, general manager, Joliet, Ill. Standardization of laundry methods is one of the major functions of this association. The new American Institute of Laundering, representing an investment of three quarters of a million dollars, was dedicated on September 16, 1930. It is controlled and operated by the association, provides complete facilities not only for research work but also for a vocational training school in all departments of laundering and a commercially operated laundry as a practical research and development institution—giving leadership to present-day practices and standards for the industry. In matters of research this association receives the cooperation of a number of other associations of national recognition, including the Cotton Textile Institute, Wool Blanket Manufacturers' Association, the Lowell Textile Institute, and the National Bureau of Standards. Its department of research is revising its authoritative Manual of Standard Practice for the Power Laundry Washroom. In other respects the activities of this association are diverse and far-reaching. They include the formulation of standards for processing laundry work in all departments; surveys previous to making recommendations for improving power-plant practice, proper maintenance of equipment, additions to existing plants, and mechanical layouts of new plants; issuance of publications dealing with the conservation of textiles, as well as proper methods of laundering them; installation of uniform methods of laundry cost accounting; and a department of merchandising. It is joint sponsor for the sectional committee on safety code for laundry machine and operations, and is officially represented on two other sectional committees on frame dimensions of electric motors, and standards and specifications for sheets and sheeting.

Lead Pencil Institute (Inc.), Nelson B. Gaskill, president, 16 Jackson Place, NW., Washington, D. C. The institute is cooperating with the division of simplified practice of the National

Bureau of Standards in revising and extending the scope of the simplified practice recommendation relating to lead pencils. This recommendation, in its original form, was established under the auspices of the division with the cooperation of the Pencil Makers Association and the Wholesale Stationers of the United States of America.

Locomotive Crane Manufacturers Association, P. A. Orton, secretary, 608 South Dearborn Street, Chicago, Ill. An important activity of this association has been the formulation and adoption of locomotive crane rating standards covering all standard gage rail locomotive crane capacities. It maintains representation on the sectional committee on safety code for cranes, derricks, and hoists.

Machinery Builders' Society, W. C. Fulmer, secretary, 50 Church Street, New York, N. Y. The society has developed a testing code for hydraulic turbines which formed the basis for the code of the American Society of Mechanical Engineers. It has also formulated specifications for bronze propellers, standard rules of obsolescence covering patterns, jigs, and fixtures; standard markings for patterns; standard contract form; and standard accounting and cost system. It is officially represented on the sectional committee on standardization of speeds of machinery.

Malleable Iron Research Institute, Robert E. Belt, secretary, Union Trust Building, Cleveland, Ohio. The official standards adopted by this institute for malleable castings for railroad and other work are those which have been formulated by the American Society for Testing Materials and the mechanical division of the American Railway Association. It helped to formulate the simplified practice recommendation for malleable foundry refractories. Through laboratory and engineering work, the institute assists its member plants in the manufacture of products which conform to the requirements of these specifications. Manufacturers whose products conform to the institute's specifications certificates are permitted to use its trade-mark in advertising.

Manufacturers Standardization Society of the Valve and Fittings Industry, Albert C. Taylor, general secretary, 103 Park Avenue, New York, N. Y. This society is joint sponsor

with the American Society of Mechanical Engineers for the sectional committee on pipe flanges and fittings. The simplified practice recommendation covering wrought-iron and wrought-steel pipe and pipe fittings was sponsored by this organization. Several of its committees are establishing standards and specifications for screw fittings, valves, hydrants, and other products.

Manufacturing Chemists' Association of the United States, Warren N. Watson, secretary, 921 Woodward Building, Fifteenth and H Streets, NW., Washington, D. C. Having standardized the tables for aqua ammonia, hydrochloric acid, nitric acid, sulphuric acid, and zinc chloride, this association has prepared specifications for graduates, thermometers, and other laboratory apparatus. Specifications for carboys, steel barrels and drums, tank cars, containers for insecticides, and miscellaneous packages are now in process. The work on standards for containers, conducted in conjunction with the Bureau of Explosives and the American Railway Association, has been completed and incorporated in the official specifications of the Interstate Commerce Commission. Developments of new containers necessitate constant attention to the question of specifications by the association's technical committees.

Maple Flooring Manufacturers Association, E. C. Singler, secretary, 332 South Michigan Avenue, Chicago, Ill. This association is interested, among other things, in the establishment and enforcement of uniform grades and standards, and improvements in methods of manufacture. It has adopted grading rules for northern hard maple, beech, and birch flooring. Pursuant to a resolution adopted at a joint meeting of this association, member manufacturers are permitted to use the association's trade-mark on all flooring which is standardized and guaranteed by the association when passed upon by the association's official inspector, provided the grade name and species of the wood is stamped on each bundle of flooring. The association has inaugurated a "car card plan" by which it furnishes certificates to manufacturers, who, in issuing them, guarantee the contents of sealed cars to be in conformity with the grading rules of this association.

Metalware Institute (Inc.), Warren S. Smith, secretary, 342 Madison Ave-

nue, New York, N. Y. This institute, formerly known as the Sheet Metal Ware Association, sponsored a movement for the elimination of needless sizes of products in the metal-ware industry. It cooperated in the formulation of the simplified practice recommendation relating to sizes of tinware, galvanized, and japanned ware. It is officially represented on the sectional committee on the safety code for power presses and hand presses.

Millers' National Federation, Herman Steen, secretary, 307 North Michigan Avenue, Chicago, Ill. This organization includes about 70 per cent of the active capacity of the milling industry. Practically all the work in standardization is carried on by committees created by the board of directors who also define the activities of each committee. The committee members are appointed by the chairman of the board. The federation's committee on package differentials has been working for a number of years on the standardization of flour packages and the differential between packages of various sizes. From time to time the committee issues a schedule of price differentials for those sizes commonly used in the industry. The accounting committee has recommended a standard system of accounting which is now being generally used by milling companies. The committee on flour definitions and standards and the committee on grain standards and inspection are cooperating with the United States Department of Agriculture in presenting the views of millers with respect to the definitions and standards of flour and by-products, and grain formulated by that department. The sales-contract committee of the federation adopted a uniform sales contract superseding a great majority of private sales contracts which were previously employed by millers.

Milling Cutter Society, The, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. Through its standing committee on simplification and standardization this society is now engaged in listing standard milling cutters in revised catalogues.

Millwork Institute of California, Lester G. Sterett, secretary, administrative headquarters, 523 T. W. Patterson Building, Fresno, Calif. The institute has issued a publication known as "Accredited Standards for Architectural Woodwork." These

standards set forth minimum requirements as regards grades of material, methods of construction and quality of workmanship to be expected in millwork items. The standards cover all items of millwork including recommended form of millwork specifications. Predicated upon the accredited standards for architectural woodwork, is a certification program, under which carefully selected manufacturers whose products conform to the provisions of the standards and who subscribe to the provisions of the license agreement, are licensed by the institute as "manufacturers of architectural woodwork." Their plants are designated by a license number issued by the institute. The initial list of licensed manufacturers included 50 different plants in California. All products of licensed members are identified by labels or stamps carrying the words "architectural woodwork" and "certified by Millwork Institute of California," supplemented by the institute insignia and the license number of the member furnishing the work. The institute is cooperating with the architects in California in the interest of the certified woodwork program.

Mine Inspectors Institute of America, C. A. McDowell, secretary, post-office box 64, Pittsburgh, Pa. The institute's standardization work on selection, installation, or use of equipment in mines is carried forward in cooperation with the American Standards Association. The institute is officially represented on the mining standardization correlating committee and is serving as sponsor on the A. S. A. sectional committee on safety code for mine explosives, and is represented on five additional sectional committees dealing with both coal and metal mining equipment and the safe operation thereof.

Mirror Manufacturers Association, North Storms, secretary, 2217 Tribune Tower, Chicago, Ill. A committee of this association cooperated in the establishment of the commercial standard for mirrors which includes five distinct grades and standards of quality based on the presence of certain defects which may be found in plate glass. The association permits its manufacturers to use self-identifying quality-guaranteeing labels on mirrors manufactured in accordance with the grades set forth in the commercial standard relating to this commodity.

National-American Wholesale Lumber Association, W. W. Schupner, secretary, 41 East Forty-second Street,

New York, N. Y. The object of this association is to promote the interests of the lumber wholesaler, to assist him in better merchandising methods, and to bring together lumber manufacturers, wholesalers and retailers for the purpose of establishing merchandising practices. 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.

National Association of Builders Exchanges, Earl F. Stokes, executive secretary, Bond Building, Washington, D. C. The objects of this organization include the promotion and protection of the general interests of the building industry of the United States. Its principal purpose is to secure and maintain the highest standard of efficiency in the erection and maintenance of buildings and in the adoption of suitable standards for the manufacture and installation of building materials, supplies, and appliances. It cooperated with the American Institute of Architects in a revision of the standard form of bond to be used in connection with the fourth edition of the standard form of agreement and general conditions of the contract. In the field of simplification this association assisted in the preparation of over 15 simplified practice recommendations covering materials used in the building industry. It has adopted a standard code of ethics and also a standard set of rules for operating quantity-survey bureaus for builders exchanges. It also took a leading part in the work of the National Committee on Wood Utilization regarding the use of short-length lumber. The association is now cooperating with the division of building and housing of the National Bureau of Standards in drafting a uniform mechanics' lien act. It is officially represented on the sectional committee on recommended practice for brick masonry.

National Association of Building Owners and Managers, Lewis B. Ermeling, executive secretary, 134 South La Salle Street, Chicago, Ill. This association comprises 40 federated local building owners and managers associations throughout the country. Its chief standardization work has been the adoption of uniform methods for floor measurement of rentable areas in office buildings and the development of

a standard classification of accounts so that managers in different cities will be able to make a comparison between their operating costs. It has also formulated and adopted a standard code of ethics. The association is officially represented on eight sectional committees dealing with safety codes, building materials, and construction.

National Association of Dyers and Cleaners of the United States and Canada, Paul C. Trimble, managing director, Silver Spring, Md. In developing standard practices for the laundry industry, this association is cooperating in research work with the Laundryowners National Association of the United States and Canada. It has developed and issued numerous standards relating to methods and practices for use in the cleaning industries, the more important of which are the following: Dry cleaning of fur and leather garments; dry cleaning, wet cleaning, and finishing of transparent velvets; wet cleaning summer suits; rug cleaning; hat cleaning and blocking; testing for deterioration of fabrics; and restoration of discolored furs. The association cooperated in the establishment of the commercial standard for Stoddard solvent. Investigational work is now in progress on dry and wet cleaning of rayon fabrics; dry-cleaning soaps; and dyeing of celanese. During the past year, the association has prepared a set of standards relating to dry-cleaning service from the standpoint of the consumer which it is planning to present to the Federal Trade Commission for approval. These standards will serve as a measure of protection to the public at large.

National Association of Fan Manufacturers, E. B. Cresap, secretary, 308 West Washington Street, Chicago, Ill. This association formulates standards and codes for fans and blowers. In cooperation with the Industrial Unit Heater Association and the American Society of Heating and Ventilating Engineers a standard code for testing and rating of unit heaters was published during the past year. Through a joint committee of the American Society of Heating and Ventilating Engineers and this association, and in cooperation with a subcommittee of the Power Test Code Committee of the American Society of Mechanical Engineers, a standard test code for disk and propeller fans, centrifugal fans, and blowers was formulated and has been in universal use since 1923.

During the past year the association adopted a standard method of designating discharge and rotation for centrifugal fans, including also arrangement for drive. It is officially represented on sectional committees on safety codes for conveyors and conveying machinery, exhaust systems, and standardization of speeds of machinery.

National Association of Farm Equipment Manufacturers, H. J. Sameit, secretary, 608 South Dearborn Street, Chicago, Ill. This association cooperates with other organizations in the reduction of variety of materials and shop equipment used in the manufacturing operations of its members. The association represents many different lines of manufacture, and because of this diversity, it has been divided into eight trade departments, the names of which indicate their scope, as follows: Ensilage machinery, farm wagon, gas engine, plow and tillage implement, pump, sprayer, tractor and thresher, and water system. Several of these trade departments have been engaged in reducing varieties and sizes of farm equipment, but the most notable accomplishment has been made by the plow and tillage implement department. This department, several years ago, succeeded in reducing varieties and sizes of plow and tillage implements from 2,156 to 255, an elimination of 88 per cent. Since that time, the growing demand for larger power farming equipment has necessarily added a number of new tools, but styles, sizes, and varieties are still being kept at the lowest possible point. This association has issued a booklet containing specifications and grading and inspection rules for wagon-wood stock. The latter rules were adopted jointly by this association and the National Hardwood Lumber Association. The association is developing specifications for materials used for farm equipment.

National Association of Finishers of Cotton Fabrics, George L. Sawyer, secretary, 320 Broadway, New York, N. Y. The membership of this association is composed of job finishers who bleach, dye, or print cotton goods according to instructions from the owner of goods. It has adopted standard methods for testing cotton fabrics to determine their fastness to light and power-laundry washing. The standards for fastness to light represent satisfactory fastness for the purpose for which a fabric was produced.

Likewise, those for washing represent satisfactory fastness to power-laundry washing with white goods. The latter standards are in accordance with the washing methods recommended and approved by the Laundryowners National Association of the United States and Canada. Arrangements have been made by the association with a commercial testing laboratory to conduct tests of all 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 standards for fast colors.

National Association of Flat Rolled Steel Manufacturers, George H. Charls, president; A. N. Flora, vice president, 511 Terminal Tower Building, Cleveland, Ohio. Standards formulated by the Association of American Steel Manufacturers, with respect to permissible variations in gage width, gage thickness, size, and flatness of sheets and light plate blue annealed, have been adopted by this association. Its simplification committee is now working on sizes and gages of sheet steel and the elimination of the use of light-weight material for roofing purposes. Another committee is conducting studies to determine the proper weight standard of zinc coating for galvanized roofing. Another problem before the association is the unification of gages in the flat rolled steel industry with a view to establishing a uniform gage, fraction or decimal practice. This organization cooperates with the United States Department of Commerce and municipalities in formulating new and revised existing building codes. In addition to cooperating with the United States Department of Commerce on the standardization of gages, it also cooperates with groups of fabricators in the establishment of standards for flat rolled steel products. It is officially represented on the sectional committees on standards and specifications for refrigerators and specifications for zinc coating of iron and steel. The trade research division of the National Association of Flat Rolled Steel Manufacturers is the research and trade extension branch of the association. This division has conducted research on the resistance

of sheet and strip steel to fire, corrosion, and lightning in farm and industrial buildings, garages, and other structures. It has cooperated with the National Bureau of Standards in conducting fire tests on all-steel garages, steel roofing, and steel office furniture and equipment.

National Association of Glue Manufacturers (Inc.), H. B. Sweatt, secretary-treasurer, 55 West Forty-second Street, New York, N. Y. During the past year the technical division of this association has revised the specifications relating to standard methods for determining viscosity and jelly strength of glue.

National Association of Golf Club Manufacturers, C. B. Johnson, secretary, 744 North Fourth Street, Milwaukee, Wis. Through a joint committee composed of representatives of this association and the Hickory Golf Shaft Association, this organization cooperated in the establishment of the commercial standard for quality of hickory golf shafts.

National Association of Hosiery and Underwear Manufacturers, J. N. McCullaugh, managing director, 468 Fourth Avenue, New York, N. Y. This association has adopted standards for moisture content and regain for mercerized cotton yarns, percentage of oil on rayon yarn for knitting, length of all hosiery, hosiery boxes, and method of measuring the size of all hosiery. During the year the association made a study of stainless lubricating oil for all knitting machines, which resulted in a tentative specification. This has received the approval of the oil refiners and the knitting industry, and many hosiery manufacturers are now purchasing lubricating oil in accordance with this tentative specification. At the request of this association and through its research associate, the National Bureau of Standards is cooperating in the development of a standard aviators' hose for winter flying, and standard specifications for the construction of all hosiery. This association maintains a research and an assistant research associate at the National Bureau of Standards for the purpose of studying methods of manufacture of hosiery and knit goods. To date over 4,200 manufacturing problems have been studied and completed.

National Association of Manufacturers of Heating and Cooking Appliances, Allen W. Williams, secretary, 3440 A. I. U. Building, Columbus,

Ohio. Although this organization, formerly known as the National Association of Stove Manufacturers, has not yet adopted any standards or specifications, it has assisted member companies in working out simplification and standardization programs within their plants. The association's committee on simplified practice is cooperating with the division of simplified practice of the National Bureau of Standards in the elimination of excess varieties of stoves and ranges burning coal, wood, or gas as fuel.

National Association of Marble Dealers, Victor Mosel, secretary, 721 Rockefeller Building, Cleveland, Ohio. Standard specifications covering the erection of interior marble work have been formulated and adopted by this association. It is officially represented on the sectional committee for safety code for walkway surfaces.

National Association of Master Plumbers of the United States, Jere L. Murphy, chairman, standardization committee, 340 East Forty-fourth Street, New York, N. Y. This organization is interested in standardizing plumbing materials and equipment of all kinds, including their installation in buildings. Practically all of this work is carried on by the standardizing committee on plumbing equipment. During the past year this committee cooperated with the Eastern States manufacturers in the standardization of copper boilers, connections, and outlets. It prepared standards for connections and dimensions of staple vitreous china plumbing fixtures and for porcelain (all clay) plumbing fixtures. At the present time the committee is engaged on the following standardization projects: Enameled iron sanitary ware, traps and water seals to prevent sewer air from entering buildings, compression faucets, flush tank mechanism and flush valves, supply pipes, escutcheons and connection to plumbing fixtures, proper connections for plumbing fixtures that are built in solid brick and concrete walls; and cast iron soil pipe and fittings. The association cooperated with the Building Code Committee of the United States Department of Commerce in the revision of the report dealing with recommended minimum requirements for plumbing. It is officially represented on five sectional committees on standardization of plumbing equipment, pipe thread, pipe flanges and fittings, gas safety code, and on standards for drawings and drafting room practice.

National Association of Mopstick Manufacturers, W. A. Babbitt, manager, Box 517, South Bend, Ind. Since its organization about a year and a half ago, this association has appointed committees to set up standards within the industry. In cooperation with the National Association of Wood Turners, it assisted in the establishment of the commercial standard for sizes and grades of mopsticks. Committees are now at work on additional standards for the mopstick industry.

National Association of Motor-Bus Operators, John M. Meighan, secretary-manager, Mills Building, Washington, D. C. As the trade association of the motor-bus transportation business, this organization is engaged in the development and promulgation of uniform practices and standards within the industry, and in the promotion of uniform laws and regulations under which the industry must function. This association has formulated a code of principles covering the basic requisites of a public-transportation service with respect to safety, reliability, and comfort, as well as the handling of traffic, interline relationships, rates, cost accounting, etc. It has also formulated a set of uniform rules covering the actual details of operation. These have been subscribed to and adopted by all members of the association. It takes an active part in the work of the National Conference on Street and Highway Safety and the Motor Vehicle Conference Committee. In connection with the latter body, this association has been influential in the development of a uniform motor-bus specifications code, which is being recommended for adoption by the various State regulatory agencies. Through its nation-wide collection and dissemination of general information on the bus, together with statistical studies covering special phases of the industry, this association is rendering a service to legislatures and other groups interested in the adoption and promotion of sound laws governing bus transportation.

National Association of Musical Instrument and Accessories Manufacturers. (See National Musical Merchandise Manufacturers Association, p. 341.)

National Association of Mutual Casualty Companies, J. M. Eaton, secretary, 180 North Michigan Avenue, Chicago, Ill. The standardization work of this association is conducted largely in cooperation with sectional

committees of the American Standards Association. It is officially represented on the safety-code correlating committee and is active in the development of industrial safety codes. It is joint sponsor with the Laundry-owners National Association of the United States and Canada and the Association of Governmental Officials in Industry of the United States and Canada for the sectional committee on safety code for laundry machinery and operations. It is also officially represented on 23 additional sectional committees.

National Association Practical Refrigerating Engineers, Edward H. Fox, secretary, 435 North Waller Avenue, Chicago, Ill. Through its committee on standards, this association assists the American Society of Mechanical Engineers, American Society of Refrigerating Engineers, American Standards Association, and other organizations in the formulation of standards for pipe flanges and fittings and codes for mechanical refrigeration and pressure piping.

National Association of Purchasing Agents (Inc.), George A. Renard, secretary-treasurer, 11 Park Place, New York, N. Y. Groups and committees within the association are working in the fields of simplification and standardization in cooperation with similar committees of other organizations and various units of the Federal Government. The association initiated the movement for a reduction of catalogue sizes which resulted in the national standard catalogue size now indorsed and accepted by 10 organizations, including the United States Department of Commerce. Committees of this association assisted in formulating simplified practice recommendations for classification of iron and steel scrap specifications, standard warehouse forms; paper sizes, and in the promulgation of standard contracts for fuel oil and pig iron. 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 preparation of standard forms of contract for erected and non-erected conveyor equipment, both of which have been approved and adopted by this association. Through the work of its own committee and in collaboration with committees of the American Electric Railway Association, National Electric Light Association, and the National Electrical Manufacturers Association, this organization initiated

the movement which resulted in the formulation of standard electrical contract forms for the purchase of electrical machinery. It also cooperated in the establishment of commercial standards for brass pipe nipples, domestic and industrial fuel oils, and dress patterns. A code relating to buying and selling, proposed by a conference composed of leading industrial executives, including sales and purchase representatives, and sponsored by the association, has been widely accepted by industrial organizations. The association is officially represented on sectional committees on standardization of gears, wire and sheet metal gages, specifications for zinc coating of iron and steel, standards and specifications for sheets and sheeting, classification of coals, and specifications for wood poles. At its annual convention held in Buffalo, N. Y., in 1929, this association adopted a resolution approving and indorsing the grade marking of softwood lumber. A resolution offering its cooperation to the division of simplified practice in the survey looking to simplification and standardization of pole line hardware was adopted at the association's 1930 annual convention held in Chicago. Several committees of this association are now engaged on the following projects: Simplification of steel filing equipment, with particular reference to color and sizes; standardization of grades and colors of fine (office and record) papers; standardization of uniform markings on valves and fittings; and simplification of laboratory glassware. The association is participating 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.

National Association of Railroad Tie Producers, Roy M. Edmonds, secretary, 1252 Syndicate Trust Building, St. Louis, Mo. Under the joint sponsorship of the American Railway Engineering Association and the United States Forest Service, this association was officially represented on the sectional committee on specifications for cross ties and switch ties which were formally approved as American standards by the American Standards Association and adopted by this and 13 other organizations.

National Association of Real Estate Boards, Arthur J. Mertzke, director, department of education and research, 59 East Van Buren Street,

Chicago, Ill. In cooperation with the American Institute of Architects, this association has established minimum standards for home building and also national standard forms for brokers and for other branches of the business, for the purpose of clarifying the relationship between broker and client. It has also adopted standards of appraisal practice for realtor appraisers and appraisal committees of local real-estate boards. This association has also formulated two standard model appraisals, one relating to office buildings and another dealing with apartment buildings. The association is officially represented on sectional committees on recommended practice for brick masonry and specifications for plastering.

National Association of Sheet Metal Contractors of the United States, W. C. Markle, secretary, 336 Fourth Avenue, Pittsburgh, Pa. The standards of recommended practice in fabricating and erecting sheet-metal ware for the building industry have been published in a book entitled "Standard Practice in Sheet Metal Work" which was prepared by the trade development committee of this association. The standards relate to the following subjects: Roofing, gutters, conductors, flashings, and corrugated-iron work; skylights and ventilators; metal cornices, metal ceilings, warm-air furnaces; heating and ventilating systems; blow pipe and exhaust systems; fire and kalamein doors; hollow metal doors and trim; hollow metal windows; restaurant, kitchen, and hotel equipment, and protective coatings and paints. Members of this association and representatives of the National Hardware Association of the United States jointly cooperated in the formulation of the simplified practice recommendation dealing with sizes for eaves trough, conductor elbows, and fittings. The association is represented on the sectional committee on specifications for zinc coating of iron and steel.

National Association of Steel Furniture Manufacturers, J. D. M. Phillips, secretary, Union Trust Building, Cleveland, Ohio. A wide variety of steel furniture is provided for in the standard specifications formulated by this body. It has also issued standards for safes which comply with the requirements of the Underwriters' Laboratories label service.

National Association of Waste Materials Dealers, Charles M. Haskins, secretary, Times Building, New York,

N. Y. Standard classifications for waste materials, including metals, rubber, paper, and cotton and woolen rags, have been established by this association and published in its Blue Book, which is issued once in every five years. During the past year it has included among its activities the newly organized National Wiping Cloth Standardization Association which functions as a division of this association. (For the activities of the N. W. C. S. A. see sketch on p. 347.)

National Association of Wood Turners (Inc.), W. A. Babbitt, general secretary, Box 517, South Bend, Ind. Much of the standardization and simplification work of this association has been in cooperation with the division of simplified practice of the National Bureau of Standards. It cooperated with the Hickory Handle Association and the Ash Handle Association in the formulation of simplified practice recommendations relating to these items. The association is also cooperating with the National Association of Mopstick Manufacturers and the division of trade standards of the National Bureau of Standards in the establishment of commercial standards for sizes and grades of mopsticks. It is now developing standards for other turned and shaped wood products. The association maintains representation on the sectional committee on safety code for woodworking plants.

National Association of Wooden Box Manufacturers, R. H. Morehouse, secretary, 111 West Washington Street, Chicago, Ill. Cooperating with the American Railway Association, the Bureau of Explosives, the Federal Specifications Board, and other regulating bureaus, this association assisted in the formulation of standard specifications for wooden boxes and crates used on the Pacific coast. It has compiled and issued publications on wooden box and crate construction and packing for foreign and domestic shipment (nailed wooden crates and boxes). It has also issued pamphlets containing new specifications for wooden boxes and crates for the use of its members. The association is officially represented on the sectional committee on safety code for woodworking plants.

National Association of Wool Manufacturers, Walter Humphreys, secretary-treasurer, 80 Federal Street, Boston, Mass. This association cooperates with the Wool Institute on matters of standardization. Through the work of its committees it has established stand-

ard definitions relating to clean wool, clean content of wool, normal condition of wool, and shrinkage. It is at present conducting a joint research with the American Association of Textile Chemists and Colorists on chemical processes and application of dyes and chemicals to materials manufactured in the wool industry. The association is officially represented on the sectional committee on safety code for textiles.

National Automobile Chamber of Commerce, Alfred Reeves, general manager, 366 Madison Avenue at Forty-sixth Street, New York, N. Y. This organization cooperates with the Society of Automotive Engineers and other associations in the development of standards and specifications for the automotive industry. It cooperated with committees of the National Conference on Street and Highway Safety in preparing and promulgating State and city traffic ordinances. The chamber is officially represented on sectional committees on safety code for automobile brakes and brake testing and on standards for graphics.

National Battery Manufacturers Association, C. M. Angell, chairman technical committee, care of Vesta Battery Corporation, 6501 West Sixty-fifth Street, Chicago, Ill. The technical committee of this association conducted a series of life and cold weather tests of batteries. The results of these tests have been published in tentative practice form and recommended for use to all members of the association. The committee is now standardizing the sizes of starting battery compartments and bus and truck batteries. The association maintains representation on the sectional committee on definitions of electrical terms.

National Board of Boiler and Pressure Vessel Inspectors, C. O. Myers, secretary-treasurer, 145 North High Street, Columbus, Ohio. This organization is composed of the chief inspectors of the various States and cities in the United States who have adopted the American Society of Mechanical Engineers' Boiler Code. Its purpose is to secure standardization in the enforcement of this code; to maintain uniformity in the construction, installation, and inspection of steam boilers and other pressure vessels and their appurtenances; and to cooperate with the A. S. M. E. code committee in the revision and interpretation of rules governing the construction, installation, and operation of steam boilers.

Boilers constructed in accordance with the A. S. M. E. code and inspected during construction by an inspector holding a national board commission may be stamped "National Board." Over 125 boiler manufacturers are now authorized by the board to place the approved stamp on their boilers.

National Board of Fire Underwriters, W. E. Mallalieu, general manager, 85 John Street, New York, N. Y., During the past year the board adopted the following standard regulations recommended by the National Fire Protection Association: Installation and operation of acetylene equipment for lighting, heating, and cooking; installation and operation of centrifugal fire pumps; installation, maintenance, and use of first-aid fire appliances; installation of pulverized fuel systems; storage and handling of photographic and X-ray nitrocellulose films; installation of pulverizing systems for sugar and cocoa; installation of class B sprinklers equipments; and suggestions for the organization, drilling, and equipment of private fire brigades. Also, in the course of the past year, the board prepared and published regulations for the construction and operation of pyroxylin lacquer manufacturing plants, and for the construction of merchandise vaults; recommended good practice requirements for the construction and protection of airplane hangars; and suggested ordinances for fire prevention, providing safeguards against fire hazards during the construction of buildings; and gave suggestions for the organization and regulation of volunteer fire departments. It has also issued a revised edition of the National Electrical Code to conform to the revisions and amendments which were adopted in 1929. As a member of the fire-protection group the board is joint sponsor with the American Society for Testing Materials and the National Bureau of Standards for specifications for fire tests of materials and construction, and with the American Society for Testing Materials for specifications for rubber-lined fire hose. The board is joint sponsor for two 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. Complete granite specifications have been established by this association. It has also formulated a uniform proposal blank which serves to standardize terms and conditions in submitting estimates, and uniform contract blanks which are recommended for general use on granite work contracts.

National Bureau of Casualty and Surety Underwriters, L. L. Hall, secretary, 1 Park Avenue, New York, N. Y. The chief activity of this bureau is standardization of safety codes, but its operations also include some standardization of a more general nature, including rating methods and practices for the several forms of casualty insurance. It is a member body of the American Standards Association, and is serving as joint sponsor for four sectional committees, as follows: Safety code for amusement parks (with the National Association of Amusement Parks); code for conveyors and conveying machinery (with the American Society of Mechanical Engineers); code for mechanical power-transmission apparatus (with the American Society of Mechanical Engineers and the International Association of Industrial Accident Boards and Commissions); code for wood-working plants (with the International Association of Industrial Accident Boards and Commissions).

National Canners Association, Frank E. Gorrell, secretary, 1739 H Street, NW, Washington, D. C. During the past year the association recommended the establishment of 27 standard sizes of cans. This recommendation was presented by the simplification committee of the association to a joint conference of canners, wholesalers, chain stores, and retailers. It was approved in principle, but the conference suggested a further survey to obtain additional data which might lead to a further elimination of several of the standard sizes. In connection with the administration of Federal laws requiring the establishment of definitions and standards for various canned foods, the association cooperates with Federal officials in the formulation of these definitions and standards. It also cooperates with both Federal and State officials in matters pertaining to proper labeling of canned foods and in efforts to prevent misbranding or adulteration. The association conducts research work in its

laboratories located in San Francisco, Seattle, and Washington for the improvement of methods, materials, and products in the canning industry.

National Cinder Concrete Products Association, Harry H. Longenecker, secretary, Insurance Co. of North America Building, Philadelphia, Pa. Cinder concrete building units, standardized as to content, dimensions, and fire-resistance qualities, are being studied by the Underwriters' Laboratories under the direction of this association. Contraction of finished product, caused by age and moisture content, is under investigation, as is the maximum permissible carbon content of cinders as a component of cinder concrete. A research associate at the National Bureau of Standards is making further studies of cinder concrete building units and their application.

National Coal Association, C. B. Huntress, executive secretary, Southern Building, Washington, D. C. This association is one of the member bodies of the American Standards Association and has participated in the formulation of standards adopted by that body. It is officially represented on the mining standardization correlating committee and on 11 sectional committees dealing with the mining of bituminous coal.

National Committee on Wood Utilization, Axel H. Oxholm, director, United States Department of Commerce Building, Washington, D. C. The committee is an impartial body composed of 155 members representing the Government and private organizations of consumers, distributors, and producers of forest products whose object is to bring about closer wood utilization and better manufacture and distribution of forest products. Fifty-five national associations are represented on the committee. During the past year the committee has completed and issued publications relating to the following subjects: The uses and economies of treated lumber, devoted to a discussion of the methods of preserving lumber and the possible use of treated lumber by the small consumer; the results of the test of the Scandinavian gang saw in converting small logs into lumber; a report on a veneer edge gluing machine which eliminates the use of tape; the second volume of a series of bulletins containing suggestions for making useful and ornamental objects from discarded wooden containers and odd pieces of lumber; a treatise on the use of wood in rayon production; and the report on saw-

dust, wood flour, and shavings which has been revised and enlarged. The second edition (consumers) of the series of bulletins to encourage the more extensive use of small dimension stock, is in preparation, as are also publications treating of the following subjects: Education of the public as to what is good design and construction in furniture, the use of insulating material in house construction, a bulletin for the prospective home owner relative to the points to be considered when judging a house, and a manual for carpenters treating of light frame construction. During the past year, in cooperation with trade and professional associations, the committee conducted a campaign to direct the attention of lumber buyers to the protection afforded them in specifying grade-marked lumber in their purchase contracts. The projects of the committee are promoted through the efforts of its members who make recommendations to the trade groups with which they are affiliated and by means of educational exhibits and publicity. In its efforts to put its recommendations into practice the committee cooperates with Government agencies as well as with other consumers and producers. The committee maintains representation on the sectional committee on specifications for wood poles.

National Cottonseed Products Association (Inc.), Earl S. Haines, executive secretary, 2610 Sterick Building, Memphis, Tenn. This association, successor to the Interstate Cottonseed Crushers Association, has formulated and adopted standard definitions of grade and quality of cottonseed; peanuts; cottonseed, peanut and coconut oils (crude and refined); peanut cake; cracked cake and screenings; cottonseed meal, whole pressed cottonseed and peanuts; peanut meal; cottonseed hulls; cottonseed linters; and soap stock and acidulated soap stock. It has also adopted standard methods of chemical analyses of cottonseed; cottonseed hulls; cake and meal; and crude and refined oils, including coconut and soybean. It has also issued rules governing the sampling, inspection, weighing, and sale of cottonseed products. This organization cooperates with the Bureau of Chemistry and Soils and the Bureau of Agricultural Economics of the United States Department of Agriculture on research in oils and fats and on the grading of cotton linters and cottonseed. In matters of trading rules it cooperates with the American Feed Manufacturers' As-

sociation and the New York Produce Exchange and other commodity exchanges. The association has recently inaugurated a plan which has become a part of the association's trading rules for the development of standard methods for grading and evaluating cottonseed. Under this plan oil mills will base their quotations on basis cottonseed and will pay premiums for quality cottonseed containing combined qualities of oil and protein (meal) above basis standard. Likewise off-quality product will bring less than basis cottonseed. The plan is designed to benefit all interests in the industry, namely, producers, shippers, ginners, and oil mills. In order to make its rules, definitions, and analyses effective, the association will expel any member from the organization who has been found guilty of misbranding or adulteration.

National Crushed Stone Association (Inc.), A. T. Goldbeck, director, bureau of engineering, 1725 Fourteenth Street, NW., Washington, D. C. In the field of research, the activities of this association are conducted by its bureau of engineering, while in matters of standardization, the work is carried on by the committee on standards under whose direction function five subcommittees dealing with the standardization of commercial sizes of crushed stone; drilling, quarry, and plant equipment; and specifications and the marking of supplies and equipment. During the past year the association's laboratory made tests on crushed stone and gravel concrete; and studied the effect of dust-coated stone on the strength of concrete, the effect of flat and elongated pieces of stone on the quality of concrete, soundness of stone, durability of mortar and concrete, stone screenings, and the stability of bituminous mixtures. Several recommendations have been made by the committee on standards, among which is one on standardization of sizes of crushed stone which the association, in cooperation with other mineral aggregates associations, is planning to submit for adoption as a simplified-practice recommendation. The association is officially represented on several technical committees of the American Society for Testing Materials in the formulation of standards for sand and stone; on committees of the American Concrete Institute in the preparation of standards for aggregates; and on the American Railway Engineering Association's committee on specifications for bal-

last. The association also cooperated with the Federal Specifications Board in the formulation and promulgation of Federal specifications relating to road and paving materials.

National Die and Special Tool Builders Association, George R. Tuthill, secretary, 40 North Wells Street, Chicago, Ill. The standardization work of this association is carried on by a committee which was appointed by the president with the approval of the board of directors. Its function is to develop standard practice rules and standard degrees of workmanship for tools, dies, and special machinery. Any standard formulated by the standardization committee must first be approved by the board of directors and then submitted to the entire membership for final approval and adoption by the association. Through its committee, it has adopted standard classification sheets for class A, AA, B, and C dies, and is now engaged in preparing a set of specification sheets covering the classification of jigs similar to those for dies. A subcommittee is now engaged in developing a standardized estimate sheet.

National District Heating Association, D. L. Gaskill, executive secretary, 603 South Broadway, Greenville, Ohio. This association has formulated rules for computing the area of radiating surface required for heating buildings. It has issued booklets and directions relating to the conservation of heat, applicable not only to district heating but also to other methods of heating. These booklets have been supplemented by a handbook which embraces the various subjects covered by district heating. It has also established recommendations relating to underground installation and the conveying of steam over considerable distances in the heating of buildings. The association is officially represented on the sectional committees on code for pressure piping, and standardization of dimensions and material of wrought-iron and wrought-steel pipe and tubing.

National Door Manufacturers Association, H. L. Stillwell, secretary, 19 South LaSalle Street, Chicago, Ill. Through its own efforts and in cooperation with other organizations, this association has adopted standard lists of doors, open sash, glazed sash, panel doors, and outside blinds, showing cuts and lists for standard designs, sizes, and layouts, and rules corresponding thereto. During the past year this as-

sociation adopted a hardwood veneer door list and revised its publication relating to standard designs of wood moldings. It is now engaged in the formulation of a slab or flush door list which will serve as a supplement to the hardwood veneer door list. The association is officially represented on, and cooperates in the work of, the Central Committee on Lumber Standards and that of the Consulting Committee on Lumber Standards.

National Education Association of the United States, J. W. Crabtree, secretary, 1201 Sixteenth Street, NW., Washington, D. C. The details for standard planning and constructing of school buildings are set forth in *School House Planning*, a book published by this association in cooperation with several other national bodies. It is officially represented on the sectional committees dealing with codes for building exits and lighting of school buildings.

National Electric Light Association, Paul S. Clapp, managing director, 420 Lexington Avenue, New York, N. Y. This association is joint sponsor with four other societies for studies of boiler feed-water problems. It is joint sponsor for two sectional committees, as follows: Insulated wires and cables for other than telephone and telegraph use (with nine other organizations); and rules for electricity meters (Code for Electricity Meters) (with the Association of Edison Illuminating Companies and the National Bureau of Standards). As a member of the electric light and power group it is also joint sponsor for a sectional committee on miscellaneous line materials. Its committee on codes and standards has formulated certain principles and practices in the standardization field which have been issued in pamphlet form. 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.

National Electrical Manufacturers' Association, A. W. Berresford, managing director, 420 Lexington Avenue, New York, N. Y. In cooperation with 45 national organizations including technical societies, trade associations, and several agencies of the Federal Government interested in various phases of standards for electrical apparatus and supplies, this association has established conference com-

mittees on standards in the electrical industry, and is joint sponsor or sole sponsor for 13 sectional committees.

The association is joint sponsor with the American Institute of Electrical Engineers for the following eight projects: Electric mine locomotive control apparatus, electric arc welding and resistance type welding, electrical measuring instruments, industrial control apparatus; line insulators for voltages not exceeding 750, oil circuit breakers, disconnecting and horn gap switches, specifications for power line insulators for voltages exceeding 750, and rotating electrical machinery. It is also 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 basing; with nine other organizations on insulated wires and cables; and with the American Mining Congress on mining locomotives for coal mines, trolley, storage battery, and combination types. 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, and instructions for their proper installation, operation and care: Electric shows and exhibits, handbook of radio standards, handbook of supply standards, industrial control standards, instruction for the care and operation of transformers, laminated phenolic products standards; motor and control instruction handbook, national electrical code—its purpose and development, need for a uniform electrical ordinance, power switchboard and switching equipment handbook, selection of direct-current motors for direct connection to centrifugal fans, standard accounting and cost system for the electrical industry, transformer standards, uniform electrical ordinance, and vulcanized fiber standards. The association encourages its member manufacturers voluntarily to accept its standards 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.

National Engineering Inspection Association, Watson Vredenburg, president, 122 Greenwich Street, New York, N. Y. This organization is made up of individuals, partnerships, or corporations regularly engaged in the

general practice of engineering inspection, and its object is to promote proper understanding and cooperation between these groups; to establish practices which will prove beneficial to proper service and to develop and encourage better and more effective inspection methods. The association is now formulating tentative methods of procedure for the inspection of: Steel, including structural (at rolling mills, fabricating plants, and during erection); reinforcing, boiler and fire-box, and castings; steel pipe; steel rails; cast-iron pipe and fittings; cement and concrete; and timber, including ties, piles, poles, and lumber used for structural purposes. The association plans eventually to adopt standard methods of procedure for the inspection of practically all materials, either separately, or in groups, for which recognized manufacturing standards, such as those of the American Society for Testing Materials, American Standards Association, and other industrial or regulatory bodies have been adopted and are now in commercial use. A code of ethics outlining the proper methods to be employed by members in their business relations with each other has been adopted by the association.

National Federation of Radio Associations (Inc.), H. G. Erstrom, executive vice president, 32 West Randolph Street, Chicago, Ill. This organization, formerly known as the Federated Radio Trade Association, has a membership of 55 associations, comprising local, State, territorial, and other radio groups engaged in the promotion and development of the radio industry. A national organization of radio wholesalers, the Radio Wholesalers Association, is affiliated with this body. The federation has not as yet engaged in standardization matters, although it has recommended standard trade practices in selling and merchandizing radio apparatus. It has also issued a booklet, nationally approved and distributed, containing a code of standards for radio advertising to prevent unfair and fraudulent advertising. The federation has created a set of registration standards both as to experience and education for radio service men. Examinations are given in local communities for the purpose of registering and grading service men into three classes, thereby placing a definite rating on every man's ability. The federation has also prepared and distributed a booklet containing a standard constitution, by-laws, and

other information to be used in the formation of local radio trades associations.

National Fence Manufacturers Institute, Charles M. Best, secretary, Oliver Building, Pittsburgh, Pa. The work of the institute is carried on by a standards committee, whose function is to make recommendations to the membership concerning standardization activities. The institute cooperated in the establishment of the simplified practice recommendation for woven-wire fencing. It is represented on the sectional committee on specifications for zinc coating of iron and steel.

National Fertilizer Association, Charles J. Brand, executive secretary, 616 Investment Building, Washington, D. C. Working under the leadership of this association, a large portion of the fertilizer-using territory has adopted a method of determining ratios of the three fertilizer ingredients in 10 per cent steps. This association cooperates with Federal and State agencies, agricultural colleges, experiment stations, and extension services.

National Fire Protection Association, Franklin H. Wentworth, managing director, 60 Batterymarch Street, Boston, Mass. During the past year committees of this association have formulated the following standard regulations which have been adopted by the association: Installation of pulverized fuel systems; storage and handling of photographic and X-ray nitrocellulose films; installation of sprinkler equipments (class B); suggestions for the organization, drilling, and equipment of private fire brigades; coal pneumatic cleaning plants; ovens for Japan enamel and other flammable liquids; marine oil terminals; oil-burning equipment; protection of openings in walls and partitions; gasoline stoves for cooking and heating; installation, maintenance, and use of piping for city gas; prevention of dust explosions in wood-flour manufacturing establishments; prevention of dust ignition in spice-grinding plants; inert gas for fire and explosion prevention; construction operations; and garages. These standards have also been adopted by the National Board of Fire Underwriters and other organizations interested in fire protection and prevention. Numerous technical committees are now actively engaged in the preparation of regulations on various subjects, including aviation fire hazards, hazardous chemicals and explosives, automatic sprinklers, blower systems,

building construction, fire pumps, and gases. The regulations on marine fire hazards prepared by this association have been approved by the American Marine Standards Committee. The association is joint sponsor for five sectional committees functioning under American Standards Association procedure, as follows: Safety code for building exits, regulations for electric wiring and apparatus in relation to fire hazard (National Electrical Code, edition of 1930), insulated wires and cables for other than telegraph and telephone use, fire-fighting equipment in metal mines, and safety codes for the prevention of dust explosions.

National Founders Association, J. M. Taylor, secretary, 29 South La Salle Street, Chicago, Ill. Standardization, as such, is outside the scope of this association. However, it is joint sponsor, with the American Foundrymen's Association, for the sectional committee on a 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 certain requirements concerning the necessary steps to be taken in developing a 4-year foundry apprenticeship.

National Hair and Jute Felt Manufacturers Association, Allen Bennett Forsberg, managing director, 10 South La Salle Street, Chicago, Ill. Standards for weights per square yard and loom run widths on jute and hair felt made by the needle loom punching process, have been approved by this association for adoption by manufacturers in the industry. A standard terminology applicable to the various jute and hair mixes is now being prepared by a committee of this association, which is also formulating standards on nature of contents, weight, and width of all principal products of the industry so as to prevent adulteration.

National Hardware Association of the United States, George A. Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa. In cooperation with the American Hardware Manufacturers Association, this association assisted in the formulation of the simplified practice recommendation for commercial sizes of steel sheets. The association is represented on numerous committees which have prepared simplified practice recommendations for loaded paper shot shells, flashlights, packages for insecticides and fungicides, and other commodities.

National Hardwood Lumber Association, L. S. Beale, secretary, 2408 Buckingham Building, Chicago, Ill. The standards, specifications, and codes of this association are based on its own standard rules for the measurement and inspection of hardwood lumber, cypress, veneers, thin lumber, and plywood. These rules are now accepted practically the world over as representing the correct standards for the grading of hardwood lumber. It has also adopted a sales code which establishes uniform practice in transactions involving the sale and purchase of hardwood lumber. The association maintains a staff of bonded inspectors in the principal producing and consuming centers of the country who are authorized to issue certificates on lumber shipments. These certificates are backed by this association with an adequate financial guarantee. It is officially represented on sectional committees on specifications for cross ties and switch ties and methods of testing wood.

National Hay Association (Inc.), Fred K. Sale, secretary, 600 Board of Trade, Indianapolis, Ind. This association established and adopted standard grades for hay and straw which formed the basis of Federal specifications for these commodities. It has also adopted trade, inspection, and weighing rules to govern the sales of hay and straw.

National Jewelers Board of Trade, B. L. Shinn, secretary, 22 West Forty-eighth Street, New York, N. Y. This board has formulated recommended practices covering descriptions of diamonds, precious stones, pearls, and their imitations. These recommendations were adopted by the industry, and were later made the basis for certain Federal Trade Commission's rules in accordance with a trade practice conference held in 1929.

National Lightning Rod Manufacturers Association, E. R. Stotts, general manager, care of Dodd & Struthers, Des Moines, Iowa. When this association was organized, a committee was appointed by the president to formulate and assist manufacturers in setting up standards for the production and installation of lightning rods. As a result of cooperative work by this committee and a committee composed of representatives of the National Bureau of Standards and the American Institute of Electrical Engineers a code for protection against lightning was prepared and published by the National Bureau of Standards.

This code has also been adopted and published by the National Fire Protection Association, and the Underwriters' Laboratories. At present this committee is cooperating with the farm fire-protection committee in keeping the standards which have already been adopted in harmony with the work of the latter committee. It is also cooperating with members of the association to insure that lightning rods manufactured by them comply with the standard requirements. The association is officially represented on the sectional committee on code for protection against lightning.

National Lime Association, Norman G. Hough, president and general manager, 927 Fifteenth Street, N.W., Washington, D. C. This association has formulated and adopted standards and specifications for: Paper; strawboard; glass; leather; insecticides, fungicides, and disinfectants; lime plaster, lime stucco, lime mortar, and lime in concrete; lime in asphalt, concrete, and earth roads; beet sugar, cane sugar, and sorghum sirup; bleaching powder, bleaching liquor, and soda; sandlime brick; silica brick; varnish; rubber; lubricating greases; textiles; animal glue and gelatin; pigments; cold-water paints; dyestuff and intermediates; and calcium carbide and cyanamide. It is cooperating with the Building Code Committee of the United States Department of Commerce, the National Board of Fire Underwriters, and the larger cities of the country in a revision of building codes; also with the Association of Official Agricultural Chemists in the formulation of standard definitions for the several terms used in connection with lime in agriculture. Through its representative on a sectional committee of the American Standards Association, this association is cooperating with various brick organizations in establishing a code of good practice for brick masonry work. It also maintains representation on the sectional committee on specification for plastering.

National Lumber Manufacturers' Association, Wilson Compton, secretary-manager, Transportation Building, Washington, D. C. Through its manufacturers' standardization committee composed of one representative from each regional or subscribing association of lumber manufacturers and timber owners, this association is engaged in the standardization of grades, sizes, and nomenclature of lumber. It has taken a leading part in the organi-

zation and activities of the Central Committee on Lumber Standards and the Consulting Committee on Lumber Standards. The association also has representation on the Hardwood Consulting Committee which has cooperated with the Central Committee on Lumber Standards in the formulation of the American standard basic provisions for hardwood lumber. The association helped to initiate the work of the building code committee of the United States Department of Commerce and in the work of the National Committee on Wood Utilization. It also cooperated in the establishment of the commercial standard for hickory golf shafts. The association licenses the use of its "Tree-Mark" on each piece of lumber in conjunction with the grade-mark, trade-mark, or species mark of licensed mills that conform to the American Lumber Standards, the lumber being guaranteed by the National Lumber Manufacturers' Association to conform to such specifications as may be branded thereon. Through committee representation the association is assisting in the standardization work of the following organizations: American Railway Engineering Association; American Society of Agricultural Engineers; American Petroleum Institute; Building Officials Conference of America, and several regional conferences of the same character; American Society of Mechanical Engineers; American Society of Heating and Ventilating Engineers; Society of Automotive Engineers; Producers Council; Aeronautical Chamber of Commerce; American Society for Testing Materials; and the Farm Advisory Council of the United States Department of Agriculture. The association maintains representation on 14 sectional committees on materials used in the construction of buildings and on safety codes for ladders, walk-way surfaces and wood-working plants. It is at present cooperating with the American Standards Association and the American Home Economics Association in the formulation of specifications for refrigerators, and with the American Society for Testing Materials in the development of standard fire tests for building material and construction.

National Macaroni Manufacturers Association, Benj. R. Jacobs, Washington representative, 2026 Eye Street NW., Washington, D. C. The definitions and standards for food products promulgated by the United States Department of Agriculture have been

adopted as the standards for this association. They include standards for alimentary pastes and definitions for purified middlings. The association has formulated tentative standards of grades relating to these products which are now being used by a few individual manufacturers in the purchase of their raw materials. All products manufactured by its members are subjected to chemical tests and analyses at the association's laboratory to determine whether or not they comply with the standards and specifications.

National Machine Tool Builders' Association, E. F. DuBrul, general manager, 617 Vine Street, Cincinnati, Ohio. The standardization work of this association is carried on in cooperation with other interested bodies. It assisted in the formulation of the simplified practice recommendation for grinding wheels, and is serving as a joint sponsor, with the American Society of Mechanical Engineers and the Society of Automotive Engineers, for the sectional committee on small tools and machine tool elements, and, with the National Bureau of Casualty and Surety Underwriters, for the sectional committee on safety code for machine tools. Several committees of this association are at present engaged in standardizing different types of machine tool elements, including tapers, tool posts, tool holders, milling cutters, spindle ends, chucks, drills, designations, and working ranges.

National Musical Merchandise Manufacturers Association, Henry C. Lomb, president, 45 West Forty-fifth Street, New York, N. Y. This organization, formerly known as the National Association of Musical Instrument and Accessories Manufacturers, has standardized the nomenclature of banjo parts and specifications for standard ukulele and standard guitar. It is now engaged in standardizing other instruments of the fretted group.

National Paint, Oil, and Varnish Association (Inc.), G. V. Horgan, general manager, 18 East Forty-first Street, New York, N. Y. Superfluous sizes of containers and color varieties in paints and varnishes have been eliminated by a joint committee on simplification, which is composed of representatives of this association and the American Paint and Varnish Manufacturers Association.

National Paper Box Manufacturers Association, Howard P. Beckett, commissioner, Liberty Trust Building, Philadelphia, Pa. This association cooperated in establishing standard min-

imum thicknesses of box board. It also issued a dictionary of terms relating to box construction, materials, machine processes, and measurements and types of boxes.

National Paper Trade Association of the United States, Frank E. Floyd, executive secretary, 420 Lexington Avenue, New York, N. Y. Through its several committees, this organization cooperated with the division of simplified practice of the National Bureau of Standards and other interested bodies in the establishment of simplified practice recommendations for gummed tape, tissue paper, paper bags, and various classes of twine. It also cooperated with the National Association of Purchasing Agents in developing standard sizes for catalogues and paper in sheets.

National Paving Brick Manufacturers Association, G. F. Schlesinger, chief engineer and managing director, National Press Building, Washington, D. C. This association continued its cooperation with the American Association of State Highway Officials and, in addition, assisted the American Society for Municipal Improvements in the preparation and adoption of standard specifications for vitrified brick pavements. These were published recently by the association. It initiated the movement which resulted in the simplified practice recommendation for paving brick. The association is represented on the committee on brick and the committee on paving materials of the American Society for Testing Materials. It is also represented on the committee on design, the subcommittee on road types, and the project committee on fillers for brick and block pavements of the Highway Research Board of the National Research Council. Through its engineering staff, the association conducts lectures to engineering schools and colleges on the subject of the manufacture and use of vitrified brick as a paving material. During the past year lectures were given at 42 institutions. It is officially represented on the sectional committee on methods of testing road and paving materials.

National Petroleum Association, Fayette B. Dow, general counsel, Munsey Building, Washington, D. C. In cooperation with the Federal Specifications Board and other organizations, this association has prepared specifications for petroleum products and has secured uniformity in testing methods and results. The National Bureau of Standards is also cooperating with

member companies of this association in this work. The association is officially represented on the sectional committee on testing of petroleum products and lubricants, and on the advisory board to the technical committee on lubricants and liquid fuels of the Federal Specifications Board.

National Preservers Association (Inc.), Daniel R. Forbes, counsel and executive secretary, 839 Seventeenth Street NW., Washington, D. C. This organization has continued its campaign for the establishment of standards and definitions for preserved fruit products. Its members have unanimously approved definitions and standards for fruit jams, preserves, jellies, apple butter, and other products, which have been formulated as a bill for congressional consideration. This bill has already been introduced in both the Senate and the House, and may be acted upon at the next session of Congress. The bill further provides that substandard products shall be labeled to indicate their actual composition, and aims to prevent adulteration or misbranding. This association cooperated in the formulation of the simplified practice recommendation for containers for fruit preserves, jams, jellies, and other fruit products, and only standard sizes are now in general use.

National Research Council, Vernon Kellogg, permanent secretary, Twenty-first and B Streets, NW., Washington, D. C. The council is composed of 11 divisions, each engaged in standardization in some particular field. The following activities, including some general activities of the council as well as work of the 11 divisions, have to do with standardization: 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 National Research Council has also published a list of industrial research laboratories, about 1,000 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 National Bureau of Standards and the American section of the International Radio-Telegraphy Union, basic work is being done on radio com-

munication including investigations of insulating materials, deterioration of paper, gumming of petroleum, mechanics, etc. The National Research Council also cooperates with the National Bureau of Standards by administering the funds contributed by certain industries to the bureau for special investigations. Through subcommittees the committee on the physics of the earth is conducting investigations on gravity and deflection from the vertical, the figure of the earth, variation in latitude, field methods for detecting unhomogeneities in the earth's crust, and other similar problems. 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 on welding wire specifications, the welding of pressure vessels, structural steel welding, the welding of rail joints, and standard tests for welds, and has issued manuals on the training of welding operators. The Highway Research Board is concerned with standards for character and use of road materials and with the structural design of roads. Other committees of this division have contributed to the standardization of processes and specifications in electrical insulation, industrial lighting, and in heat transmission, in the latter case through the issuance of test codes for thermal insulation at different ranges; and in the standardization of nomenclature and definitions. The Division of Chemistry and Chemical Technology acts as the American section of the International Union of Pure and Applied Chemistry and appoints the American representatives on the committees of the union, among which are the committees on the reform of inorganic, organic, and biological chemical nomenclature; the committee on chemical elements; the committee on industrial hygiene; the committee on thermochemical data; the committee on international bureau of physicochemical standards; and the committee on tables of constants. 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, and have studied methods for

the improvement of gravity measurement, for the measurement of geological time by atomic disintegration, for the recording of field data of earthquakes, and for shore line and mean sea level determinations. Committees of the Division of Medical Sciences have developed methods of classifying blood for purposes of transfusion, have formulated standard methods for the agglutination test in the diagnosis of infectious abortion and established a series of culture strains of the organism, *Brucella*, which causes this disease, have studied the limits of tolerance of the dust hazard in certain industries, and have brought together data on the functions of the office of coroner and medical examiner and on the laws governing the disposition of the dead human body in the several States of the Union. Committees of the Division of Biology and Agriculture are engaged in the development of standard breeding records for farm animals, in the establishment of pure strains of experimental animals and plants, 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 for the Fifth International Botanical Congress. The Commission on Standardization of Biological Stains, now an independent body, was developed from earlier work of this division of the council. In the Division of Anthropology and Psychology a committee on the psychology of the highway is devising highway signs and signals which will be in accordance with the correct principals of vision and mental reaction, is attempting to set safe limits of defective vision for drivers, and is considering the possible adaptation of systems of mental and physiological tests to the examination of drivers of automobiles, public, and private. The council cooperated in the formulation of the simplified practice recommendation for paper. It maintains representation on sectional committees on definitions of electrical terms, safety code for automobile brakes and brake testing, and on classification of coals.

National Restaurant Association, F. J. Wiffler, secretary, 6 North Michigan Avenue, Chicago, Ill. A committee of this association has prepared a simplified record-keeping system for restaurants. It has also approved and adopted a standard of business prac-

tice for all those engaged in the restaurant business, public, industrial, and institutional. It sponsored the movement which resulted in the simplified practice recommendation for cafeteria and restaurant chinaware. The association has formulated a proposed model law for adoption by State legislatures to regulate sanitary conditions in restaurants and other public places where food is prepared or sold for consumption on the premises. The work of presenting this bill before the various State assemblies is under the direction of the legislative committee of the association.

National Retail Dry Goods Association, Channing E. Sweitzer, managing director, 225 West Thirty-fourth Street, New York, N. Y. Several committees and bureaus of this association are engaged in simplification and standardization work. In cooperation with millinery and furniture industries, the Bureau of Trade Relations has adopted standards of trade practices to eliminate abuses and undesirable methods. In cooperation with the Silk Association of America standard trade practices have been developed to serve as guides in the purchase and sale of silk piece goods. In cooperation with the division of simplified practice of the National Bureau of Standards, a committee of the Store Managers' Division has completed a survey for the simplification and standardization of wrapping and packing supplies and methods as encountered in department and specialty stores. Major items of store supplies included in this survey are bags; boxes, set-up, folding, and corrugated; wrapping paper, twine; and gummed tape. The data collected are now being analyzed, and it is expected that they will form the basis for the establishment of simplified practice recommendations on several items. The association cooperated in the establishment of commercial standards for dress patterns and men's pajamas. The association operates and controls the Better Fabrics Testing Bureau, which is maintained as a service laboratory for its member stores. It is officially represented on the sectional committees on safety code for elevators and escalators, standards and specifications for refrigerators, and sheets and sheeting.

National Retail Hardware Association, H. P. Sheetz, managing director, Meyer-Kiser Building, Indianapolis, Ind. This organization assisted in the establishment of simplified-practice recommendations for files and

rasps, paint and varnish brushes, cut tacks and small cut nails, loaded paper shot shells, builders' hardware, woven-wire fence, shovels, garden hose, and forged tools. The association maintains representation on sectional committees on specifications for dry cells and batteries and on standards and specifications for refrigerators.

National Retail Lumber Dealers Association, Adolph Pfund, secretary-manager, 326 West Madison Street, Chicago, Ill. This association has adopted the American lumber standards for grades, sizes, and nomenclature for softwoods, and is urging its member-companies to adhere to them, including use of the tally car card. The association is urging all lumber manufacturers' associations to adopt standard specifications as to moisture content and to incorporate such specifications in their grading rules, just as the Southern Pine Association has already done.

National Safety Council, W. H. Cameron, managing director, 20 North Wacker Drive, Chicago, Ill. The council has issued a total of 143 health and safe-practices pamphlets, the last six during the year, as follows: Nursing service in industry, nontraffic hazards of the commercial driver, selecting drivers for commercial vehicles, bakery operations, macaroni plants, and marine boilers. The council is sponsor or joint sponsor for 16 sectional committees, as follows: Safety code for floor and wall openings; safety code for forging and hot-metal stamping, with the American Drop Forging Institute; code on identification of gas-mask canisters; identification of piping systems, with the American Society of Mechanical Engineers; industrial accident statistics code, with the National Council on Compensation Insurance and the International Association of Industrial Accident Boards and Commissions; safety code for paper and pulp mills; safety code for power presses and foot and hand presses; safety code for rubber mills and calendars, with the International Association of Industrial Accident Boards and Commissions; safety code for textiles; colors for luminous traffic signals, with the American Association of State Highway Officials and the National Bureau of Standards; safety code for window washing; ladders; compressed-air machinery; construction safety code, with American Institute of Archi-

tests; rubber machinery code, with International Association of Industrial Accident Boards and Commissions; and safety code for walkway surfaces.

National Sand and Gravel Association, V. P. Ahearn, executive secretary; Stanton Walker, director, engineering and research division, Munsey Building, Washington, D. C. Recommendations and specifications relating to the grading and quality of aggregates are set forth in summaries compiled by this association dealing with the following subjects: Sand and gravel for concrete and concrete-pavement construction, tables of quantities of materials for concrete, sand for sheet asphalt, plaster sand, engine sand, filler sand, glass sand, grading of gravel ballast, and filter gravel. This association is cooperating with several committees of the American Concrete Institute, the American Society for Testing Materials, the American Standards Association, and the Federal Specifications Board in the establishment of specifications for sand and gravel for concrete, sand for plaster, and sand and gravel for road construction. In the formulation of specifications and tests for washed gravel ballast for railroads, the association cooperates with the committee on ballast of the American Railway Engineering Association. It is now collaborating in the preparation of a simplified-practice recommendation relating to commercial sizes of sand and gravel. A committee of this association is engaged in the preparation of a standard cost-accounting system. The testing and research laboratory is concerned with making general investigations of the use of sand and gravel in addition to routine and special tests conducted from time to time on the products of members' plants. Progress reports of studies made by the laboratory are prepared and published in bulletin form or as a report of the engineering and research division at the association's annual convention. The association has also issued bulletins dealing with the following subjects: Estimating quantities of materials for concrete; relation of aggregates to concrete, representative specifications for different uses of sand and gravel, effect of characteristics of coarse aggregates on the quality of concrete, the effect of recent mix design and control upon field concrete, the story of glacial sands and gravels, effect of addition of finer sizes to gravel on strength of

concrete, effect of soft particles of coarse aggregate on strength and durability of concrete, and the effect of grading of gravel and sand on voids and weights.

National Scale Men's Association, C. L. Richard, secretary-treasurer, National Bureau of Standards, Clearing Station, Chicago, Ill. This association has adopted specifications for railway track scale test weight cars; design, manufacture, and installation of railroad track scales for light industrial service; and a standard form for reporting tests and inspections of railroad track scales. The two former standards and specifications were prepared by committees of this association in cooperation with the American Railway Engineering Association and approved by both organizations. A standardization project brought to completion during the past year was the adoption of specifications for the overhauling and repair of heavy capacity scales.

National School Supply Association, J. W. McClinton, executive secretary, 176 West Adams Street, Chicago, Ill. Color finish for all wood equipment used in schools and standard sizes for folding and portable wooden chairs and for composition blackboards are included in the simplified practice recommendation covering these items formulated and published by the division of simplified practice of the National Bureau of Standards in cooperation with this association and other interested bodies. It makes use of labels to identify school furniture complying in color with the standards established by the industry.

National Slag Association, H. J. Love, manager, 937 Leader Building, Cleveland, Ohio. This association is actively cooperating with the Federal Specifications Board on highway construction materials, and with the United States Bureau of Public Roads, National Bureau of Standards, American Society for Testing Materials, American Concrete Institute, American Society of Civil Engineers, American Railway Engineering Association, American Association of State Highway Officials, and other bodies on subjects pertaining to general construction. It has formulated and adopted a recommended specification for slag to be used in highways and highway structures. During 1930 its research laboratory has been carrying on work on a 10-year test program, which was inaugurated in 1929, relating to the

properties of concretes made with 32 different aggregates, including trap-rock, granite, limestones, dolomite, gravels, and slags. The association has also sponsored an investigation of all sewage trickling filters in the United States in which slag aggregate was used as the filtering medium, the report of which was published early in 1930. Other investigations inaugurated or completed during the year at the association's laboratory include those dealing with yield of concretes; effect of calcium chloride on strengths; and tests on high-early-strength concrete.

National Slate Association, W. S. Hays, secretary, Drexel Building, Philadelphia, Pa. Standard specifications for slate for floors, terraces, and walks, and slate for flat and sloping roofs have been formulated and adopted by this association. It initiated the movement which resulted in the simplified-practice recommendation for structural, roofing, and blackboard slate. The association is officially represented on three sectional committees: Safety code for walkway surfaces; standardization of plumbing equipment; and safety code for cranes, derricks, and hoists.

National Supply and Machinery Distributors Association, George A. Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa. A committee on simplification of this organization cooperates in formulating simplified-practice recommendations for various commodities used in the industry.

National Tent and Awning Manufacturers Association, J. E. Dilg, president, 116 South Fourth Street, St. Louis, Mo. In cooperation with the Cotton-Textile Institute, this organization prepared a pamphlet in which are set forth standard definitions of terms relating to cotton fabrics in the awning, tent, and tarpaulin trade. At its 1930 annual convention this association adopted resolutions relating to definite standard practice for the marking of waterproof fabric products with a printed tag or stencil by their actual gray untreated fabric weight per square yard, and also for the marking of each cover or tent to show the commercial type of fabric used. These resolutions have been referred to the National Bureau of Standards for the purpose of forming a basis of cooperation for the establishment of a commercial standard relating to these items.

National Terra Cotta Society, W. F. Lockhardt, secretary-director, 230

Park Avenue, New York, N. Y. This association has prepared a volume entitled "Terra Cotta—Standard Construction" in which are set forth the correct uses for which terra cotta should be employed. To assist architects and engineers in drawing up specifications, 67 large-scale plates of typical architectural details are included. In cooperation with the American Institute of Architects, standard specifications for the manufacture, furnishing, and setting of terra cotta have been formulated and adopted. The association maintains two research associates at the National Bureau of Standards investigating architectural terra cotta. It is officially represented on the sectional committees on fire tests of building construction and materials, and architectural terra cotta and methods of setting.

National Tuberculosis Association, Kendall Emerson, M. D., managing director, 370 Seventh Avenue, New York, N. Y. A committee of this association has formulated minimum standards relating to sanatorium administration, which have been adopted by the American Sanatorium Association and the National Tuberculosis Association. During the past year this association adopted standards for the diagnosis and classification of tuberculosis of the lungs and the tracheo-bronchial lymph nodes.

National Wall Paper Wholesalers' Association, Justin P. Allman, president, 1522 Chestnut Street, Philadelphia, Pa. This association actively cooperates with the Wall Paper Association of the United States in the standardization of wall paper. It initiated the movement for the establishment of sizes, grades, and quality of wall paper which resulted in the formulation of the commercial standard for these items.

National Warm Air Heating Association, Allen W. Williams, managing director, 3440 A. I. U. Building, Columbus, Ohio. This association formulated and adopted a standard code regulating the installation of gravity warm air heating systems in residences. This code has also been approved and adopted by the American Society of Heating and Ventilating Engineers and the National Association of Sheet Metal Contractors of the United States. The association has also adopted a symbol which is placed on furnaces indicating that they have been installed in accordance with the requirements set forth in the associa-

tion's standard code. Only those installers who have pledged themselves to install furnaces according to the standard code are entitled to use the symbol. The installation is triply indorsed by the installer, the furnace manufacturer, and the association.

National Wholesale Druggists' Association (Inc.), E. L. Newcomb, secretary, 51 Maiden Lane, New York, N. Y. To aid the wholesale druggists and manufacturing druggists of the United States, this association has developed the simplified invoice form and the standard price card. In cooperation with the Wholesale Stationers' Association of the United States of America, it has adopted a standard size catalogue page with recommendations as to the style of printing and size of type to be used. The association also cooperated in the establishment of the commercial standard for clinical thermometers. It is now studying cost accounting and operating accounting methods.

National Wholesale Grocers' Association of the United States, M. L. Toulme, secretary, 6 Harrison Street, New York, N. Y. The association cooperates with manufacturers and canners in the formulation of standards for sizes of containers for canned foods.

National Wiping Cloth Standardization Association, Charles M. Haskins, secretary, Times Building, New York, N. Y. This association, which has been recently organized, functions as a division of the National Association of Waste Material Dealers. Its object is to make guaranteed wiping cloths available to the consumer, through cooperation of the varying interests of the industry. The guaranteed plan provides that every member may continue to sell his wiping cloths under any classification or designation he desires. 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 of quality. These cloths will be known as "NAWMD Certified Wipers," and to each member desiring to handle wiping cloths under such a guarantee the association will furnish a certificate bearing a permit number and a standard tag which may be placed in or attached to bales or packages. Those members who desire to take advantage of this plan will be expected to sign an agreement to observe certain obligations.

Natural Gasoline Association of America, Ray E. Miller, secretary, Tulsa Building, Tulsa, Okla. Development and adoption of official specifications and test methods for natural gasoline and a tentative code for testing natural gas for gasoline content formed an important part of the work of this association. It is now studying the standardization of new natural gasoline specifications, casing head contract forms, monthly statements and meter charts, specifications for liquefied-petroleum gases, and aviation-fuel specifications.

New England Council, Dudley Harmon, executive vice president; Ray M. Hudson, industrial executive, Statler Building, Boston, Mass. Since its organization by the governors of the six New England States in 1925, the council has done much to further the economic interests of this region. Its membership comprises agricultural, commercial, industrial, and other business organizations. In the interest of national prosperity, the council has for its primary objects, among other things, the development of industries through standardization and research, and of agricultural prosperity through the farm marketing program inaugurated about four years ago. This latter program encourages producers to grade and pack their products according to official State standards, and to identify them by means of quality labels placed on the containers or packages in which the goods are packed. In making this program effective, the commissioner of agriculture in each of the six States has been granted legislative authority to establish and promulgate voluntary grades and standards for farm products. Several such grades are now in use in each State. The commissioner of agriculture has also been given authority to adopt a suitable label for identifying such products graded and packed according to established standards. The New England quality label has been adopted by each State and 4,077,756 labels (up to October 1, 1930) have already been used for this purpose. In establishing official grades and standards for farm products, conferences are held by the commissioner of agriculture with groups of producers who are especially interested in the products for which grades and standards are to be adopted. At these conferences tentative standards and descriptive terms are freely discussed before final adoption. An attempt is made to keep the grade names, re-

quirements, and descriptive terms as uniform as possible in all New England States, and in harmony with the recommendations of the Federal Government. Before the adopted grades and standards can become effective, they must be advertised in the press according to the law requirements of the States. Permission to use the New England quality label must be obtained from the commissioner of agriculture, and it may only be used on goods packed in accordance with official State grades. To protect the reputation of the quality label, each State department of agriculture maintains an inspection service with trained field men whose duties are to examine graded and labeled products to determine whether or not the products so graded and labeled comply with the necessary requirements. The following grades have been established in the different New England States: Maine, potatoes, eggs, apples, and jelly; New Hampshire, eggs, apples, maple products, and potatoes; Vermont, maple products, eggs, potatoes, butter, honey, apples, and turkeys; Massachusetts, eggs, asparagus, baby chicks, turkeys, hatching eggs, strawberries, celery, bunched carrots, beets, turnips, radishes, apples, and tomatoes; Rhode Island, eggs, bunched beets, carrots, radishes, turnips, hatching eggs, baby chicks, poultry breeding stock, and turkeys; Connecticut, eggs, asparagus, bunched beets, carrots, celery, turnips, strawberries, turkeys, and tomatoes. The council's activities in the fields of simplification and standardization are conducted by its industrial and research committees, whose work is reflected in a series of publications dealing with the use of research in developing old products and introducing new ones, bettering production methods, and stabilizing employment.

New England Water Works Association, F. J. Gifford, secretary, 715 Tremont Temple, Boston, Mass. This association is cooperating with the American Gas Association, the American Society for Testing Materials, and the American Water Works Association in the standardization of materials and equipment used in water-works construction. It is joint sponsor for the sectional committee on specifications for cast-iron pipe and special castings.

New York Produce Exchange, William C. Rossman, secretary, 2 Broadway, New York, N. Y. Committees have been appointed to regulate the

inspection, quality, and standards of the various commodities handled by the exchange, as follows: Cottonseed products; hay and straw; animal oils and fats; provisions, including pork and beef in barrels or tares, or any sweet-pickled or dry-salted meats; vegetable oils, waxes, and fats; lard; grain; flour; and petroleum. In making tests for animal and vegetable oils, waxes, and fats and cottonseed oil, the exchange employs the methods adopted by the American Oil Chemists' Society, or by the American Association of Official Agricultural Chemists. All samples are submitted for analysis to the bureau of chemistry of the exchange and analyzed or graded. Certificates of quality are issued covering the analysis or grading.

Nonferrous Ingot Metal Institute, R. D. T. Hollowell, secretary-manager, 308 West Washington Street, Chicago, Ill. Members of this institute cooperated with a committee of the American Society for Testing Materials in the formulation of revised tentative specifications for copper base alloys in ingot form for sand castings, which have been approved by the institute. It maintains a research associate at the National Bureau of Standards conducting research on brass and bronze ingot metal.

North Carolina Pine Association, G. L. Hume, secretary, National Bank of Commerce Building, Norfolk, Va. The adoption by this association of the recommendations of the Central Committee on Lumber Standards covering specifications for moisture content has recently been followed by a revision of the official inspection rules of the association covering kiln and dried lumber to conform to the grading rules and sizes of American lumber standards.

Northern Hemlock and Hardwood Manufacturers' Association, O. T. Swan, secretary-manager, Oshkosh, Wis. In furtherance of its standardization program which is conducted through membership on the Central Committee on Lumber Standards as well as through the activity of its own bureau of grading and inspection, this association has adopted the following: Grading rules for hemlock and tamarack lumber which conform to American lumber standards for yard lumber; a system of branding and grade marking whereby a member firm is assigned an identifying number and is licensed to use the association's brand to show that its hemlock lumber product is graded in accordance with American lumber standards;

rules of the National Hardwood Lumber Association relating to the measurement and inspection of hardwood lumber, veneers and plywood; a system of association certificates issued by licensed lumber manufacturers under a contract with the association whereby a member firm certifies the manufacturer's original tally and inspection and places the same in a sealed envelope in each car of lumber shipped, such certificate carrying a coupon guaranteeing an impartial association inspection in case of a claim on grade or tally.

Northern Pine Manufacturers' Association, W. A. Ellinger, secretary, 1103 Lumber Exchange, Minneapolis, Minn. This association took an active part in the establishment of American lumber standards rules for sizes and grades of lumber. The rules of this association for Northern white pine, Norway pine, spruce, and tamarack lumber have been revised to conform to those of the American lumber standards. In order to insure that lumber manufactured by member mills complies with the provisions of American lumber standards, this association maintains an inspection bureau for the purpose of supervising the grades of lumber at the sawmills and furnishing reinspection service to buyers.

Northern White Cedar Association, Norman E. Boucher, secretary, 702 Lumber Exchange, Minneapolis, Minn. This association has formulated and adopted official manufacturing specifications governing the manufacture and grading of northern white cedar poles, 16 feet and longer, and cedar guard-rail posts. The association is endeavoring to induce the various State highway authorities to adopt its standard specifications for guard-rail posts for use on highways. It is officially represented on the sectional committees on the National Electrical Safety Code and on specifications for wood poles.

Oak Flooring Manufacturers' Association of the United States, W. L. Claffey, secretary, 1812 Sterick Building, Memphis, Tenn. This association, comprising a membership of about 95 per cent of the producers of oak flooring, has completely standardized the technical phases and physical details of all oak flooring produced in the United States. It has established standard rules for the various grades of flooring as well as standard thicknesses and widths, measurement and counts. The past year, the association organized a research division to establish universal standards for the lay-

ing, finishing, and maintenance of oak flooring and to develop the further useful and decorative possibilities of this material. The association is officially represented on the sectional committee on safety code for woodworking plants.

Outdoor Advertising Association of America (Inc.), Joseph Harris, secretary, 165 West Wacker Drive, Chicago, Ill. Through its division of plants, this association has set up standard dimensions for the building and construction of steel frame and wooden frame posters and bulletins for use in city and suburban districts, along highways, railroad sites, and stores. It has also established standards for equipment for illuminating bulletins and posters. The association's manual contains standards which have been adopted for location; size of structures; service; and copy, the last dealing with the kind and quality of advertisements that members of this association should not display. During the past year this association put into effect standard set showings of equal advertising value for the purpose of giving a display of equal value to every advertiser.

Paperboard Industries Association, G. R. Browder, general manager, 608 South Dearborn Street, Chicago, Ill. This association is composed of manufacturers of paperboard, corrugated and solid fiber boxes, and folding boxes. All of its work in standardization and simplification is carried on by a standardization committee, the functions of which are to study and recommend changes in or additions to the existing standards for paperboard, containers, and folding boxes, and specifications for such material as tape, adhesives, etc. Several years ago, the association issued a booklet in which are set forth the standards it has adopted, including those relating to definitions, gage lists, test container boards standards (also weight basis of nontest boards), contract form, and rules for figuring weight of odd sizes. It has also issued a book dealing with carriers' specifications and regulations with respect to shipment of merchandise in various types of corrugated and solid fiber containers. In the field of simplification, this association sponsored the movement which resulted in the simplified practice recommendation for boxboard thicknesses. It has cooperated in the establishment of certain standard sizes for folding paperboard boxes to contain one pound of coffee, and is now

cooperating in the development of standard sizes of shipping containers for canned foods. This organization extends to its members the privilege of using the association's insignia in connection with the certificate used by manufacturers, showing that boxes bearing these certificates conform to all construction requirements of the Consolidated Freight Classification or the Official Express Classification.

Pine Institute of America (Inc.), C. F. Speh, secretary-manager, Barnett National Bank Building, Jacksonville, Fla. In the field of production this association is continuing its efforts to standardize on the size of trees to be worked for naval stores. It is also studying standardization in methods of stilling to define the temperature range, and the technique of maintaining proper relationship of condensed water and spirits of turpentine. Its recommended changes in the specifications for rosin containers have been adopted by the boards of trade and chambers of commerce at the primary naval stores ports. The association is also interested in reducing the variation in tare of these containers. It has cooperated with the American Society for Testing Materials in standardizing methods for determining foreign matter in rosin.

Plate Glass Manufacturers of America, P. A. Hughes, secretary, First National Bank Building, Pittsburgh, Pa. This association cooperated with a technical committee of the Federal Specifications Board in the preparation of the Federal specification covering plate glass for glazing purposes.

Plumbago Crucible Association, C. H. Rohrbach, secretary, 90 West Street, New York, N. Y. Under the joint sponsorship of the American Foundrymen's Association, this organization served on the sectional committee dealing with outside dimensions of crucibles for melting furnaces in nonferrous foundries which were approved as American standard by the American Standards Association and adopted by both organizations. During the past year this association has prepared standards dealing with crucibles used in tilting furnaces.

Plywood Manufacturers Association, Alexander D. King, acting commissioner, 178 West Adams Street, Chicago, Ill. This association has adopted the National Hardwood Lumber Association's rules for measurement and inspection of veneers, thin

lumber, and plywood. It is officially represented on the sectional committee on safety code for woodworking plants.

Portland Cement Association, W. M. Kinney, general manager, 33 West Grand Avenue, Chicago, Ill. The membership of this organization includes over 80 per cent of all Portland cement manufacturers in the United States, Canada, Cuba, Mexico, and South America. Organized to improve and extend the uses of concrete, this association has cooperated with the American Society for Testing Materials in formulating specifications and tests for Portland cement recognized as the American standard, and all of its members manufacture in accordance with these specifications. It also cooperates with the American Concrete Institute, American Concrete Pipe Association, American Standards Association, American Petroleum Institute, American Society for Municipal Improvements, American Association of State Highway Officials, National Bureau of Standards, and other organizations in the formulation and adoption of specifications for Portland cement, concrete aggregates, construction of buildings, highways, and other structures. In collaboration with the Cast Stone Institute, it prepared an architect's specification for cast stone, which was adopted as a tentative standard of the institute. The association assisted in the formulation of the simplified practice recommendation for concrete building units. At the annual meeting of the American Society for Testing Materials in June, 1930, the association, through representation on the A. S. T. M. Portland cement committee, assisted in the adoption of certain revisions in the standard specifications for Portland cement. It is also represented on the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete and on the Joint Culvert Committee. The association has prepared and published standards and specifications for floor finish; and making, placing, and curing concrete in cold weather. It has also issued a charted summary of concrete road specifications to aid State and county highway departments in modernizing their specifications. It has also republished and distributed A. S. T. M. specifications for Portland cement and drain tile; American Concrete Institute's tentative specifications for reinforced concrete sewer pipe, reinforced concrete culvert pipe, and handbook of reinforced concrete build-

ing design; and the American Concrete Pipe Association's specifications for sewer pipe. The association cooperates with many of the principal universities and colleges of the country in giving courses in the design of concrete mixtures, and with engineers, contractors, and architects in the practical application of this knowledge in the field; and with highway officials in the solution of road-building problems. In its Chicago headquarters is maintained a research laboratory with a staff of 30 or 40 scientists, technicians, and assistants engaged in the study of concrete and concrete materials. Eight research associates are stationed at the National Bureau of Standards investigating the constitution and hardening of Portland cement. The association maintains representation on seven sectional committees on building materials and construction.

Power Transmission Association. W. S. Hays, executive secretary, Drexel Building, Philadelphia, Pa. Proposed specifications for leather belting, standardization of speeds of driven machines, and safety code for mechanical power transmission apparatus are the chief projects of the committees of this association. These projects are being carried forward through the association's representation on American Standards Association sectional committees.

Radio Manufacturers Association (Inc.). M. F. Flanagan, executive secretary, 32 West Randolph Street, Chicago, Ill. This association cooperates with the Institute of Radio Engineers, National Electrical Manufacturers Association, National Bureau of Standards, and other bodies interested in radio standardization (engineering and manufacturing). Its work is conducted by the standards section, which consists of a general standards committee and such divisional committees as the director of the engineering division may decide upon. Each divisional committee is composed of a chairman and representatives of member companies of the association, and the chairman of each divisional committee, together with a number of members at large equal to the number of divisional committee chairmen, and the director of engineering, ex officio, comprise the personnel of the general standards committee. The personnel of this committee shall be approved by the director of the engineering division and by the board of directors. Standards and recommended practices formulated by the several divisional

committees are submitted to the general standards committee for consideration or approval. Following approval by the general standards committee, the proposed standards and recommended practices are, in turn, submitted to the association counsel for legal approval. Following this procedure, the executive secretary mails to each member company a letter ballot which contains the full text of the proposed standards or recommended practices with spaces for recording affirmative or negative votes for each separate standard or recommended practice. All members not replying by vote in writing within the 30-day limit are considered as having voted affirmatively. Before a standard can be adopted by the association, it must receive a 90 per cent affirmative vote by the member companies. Any proposed standard that fails to receive a 90 per cent vote, but which receives a two-thirds vote, may be published as a recommended practice. The association has issued a handbook of standards and engineering information in which are incorporated the standards and recommended practices recommended by the association relating to the following subjects: General terms, nomenclature, and definitions; tests and test methods; radio receivers, general standards and definitions; component parts and batteries; loud speakers and head sets; phonograph apparatus; cabinets; vacuum tubes; and television. The association is officially represented on the sectional committee dealing with radio.

Rail Steel Bar Association. H. P. Bigler, engineering secretary, 228 North La Salle Street, Chicago, Ill. Several committees of this association are interested in standardization. The committee on metallurgy and production, composed of chief metallurgists of the member companies, furnishes consulting service on production problems and prepares recommendations covering improvement in the quality of bars. The association's committee on tolerances and variations issues recommendations concerning tolerance limits for size and weight of various products. The association also maintains a works managers division composed of superintendents of each member plant whose function is to cooperate with the committee on metallurgy in securing the adoption of standard mill practices and improved methods. The association is now considering the adoption of standard con-

tract forms and terms, and standard office procedure for accounting and cost keeping. In the general building and construction, as well as technical fields, the association cooperates with the American Society for Testing Materials, American Concrete Institute, Portland Cement Association, Federal Specifications Board, American Standards Association, joint committee on concrete and reinforced concrete, and other similar organizations in the promulgation and adoption of specifications for rail steel bars for reinforced concrete construction, uniform building requirements and design practices, and in sponsoring research on reinforced concrete design and construction. The association also cooperated in establishing 11 standard sizes of steel reinforcing bars as set forth in a simplified practice recommendation. The members of this association are permitted to roll a uniform identification mark on deformed rail steel reinforcing bars produced by them. The use of this mark which is protected by registration signifies a willingness on the part of manufacturers to certify that bars produced by them comply with the requirements and tests of certain nationally-recognized specifications which have been adopted by the association.

Railway Accounting Officers Association, E. R. Woodson, secretary, 1124 Woodward Building, Washington, D. C. Much of the work of this organization is carried on by standing committees to which all recommendations are submitted for consideration before final action is taken by the association. It has adopted standard classifications, uniform interline accounting, and simplified accounting procedure, and cooperated with the American Railway Association, the National Association of Purchasing Agents, and the National Association of Cost Accountants in drawing up the simplified practice recommendation for commercial forms. The association cooperated with the Interstate Commerce Commission in the establishment of a standard system of accounting for carriers and also in the promulgation of specifications for forms and reports required of the carriers.

Railway Fire Protection Association, R. R. Hackett, secretary, Baltimore & Ohio Building, Baltimore, Md. This association has adopted regulations promulgated by the National Board of Fire Underwriters and the National Fire Protection Association

covering fire hazards and the proper installation, maintenance, and use of first-aid fire appliances. In its standardization work, this association is represented on sectional committees dealing with the following projects: Code for building exits, screw threads for hose couplings (other than fire-hose couplings), cotton rubber-lined fire hose, fire-fighting equipment in metal mines; and safety codes for the prevention of dust explosions.

Refrigerating Machinery Association, Fred Nolde, secretary, 23 South Fifty-second Street, Philadelphia, Pa. Through its standardization committee, this association is cooperating with numerous bodies in simplification and standardization projects. It has adopted specifications for the compression system of refrigeration, and also the standard ton of refrigeration, and the safety code for mechanical refrigeration, the last two having been prepared by the American Society of Refrigerating Engineers. The committee is now represented on a sectional committee dealing with the standardization of ammonia and carbon-dioxide valves, flanges, and fittings. The association is also represented on the joint research committee on welded pressure vessels which is now revising the unfired pressure vessel code of the American Society of Mechanical Engineers. It is cooperating with commercial refrigerator manufacturers in the standardization of construction details for commercial refrigeration installations. The association is officially represented on other sectional committees, as follows: Safety code for mechanical refrigeration, code for pressure piping, standardization of dimensions and material of wrought iron and wrought steel pipe and tubing, frame dimensions of electric motors, and standardization of speeds of machinery.

Rice Millers' Association, R. L. Weber, secretary-treasurer, P. O. Box 1289, New Orleans, La. This organization maintains a corps of samplers in the field to test rice for grade and quality, the grades requiring conformity with the standards for milled, brown, and rough rice established by the United States Department of Agriculture. Standards to cover transactions in rice and rice by-products have been promulgated by this association in cooperation with the National Wholesale Grocers' Association of the United States.

Rubber Manufacturers Association, A. L. Viles, general manager, 250 West

Fifty-seventh Street, New York, N. Y. During the past year this association formulated model specifications for various types of conveyor and elevator belting, which will serve as the basis for a conference between mechanical rubber goods manufacturers and engineering firms in an effort to eliminate existing diversity in customers' specifications and to promote the use of standard specifications that closely represent recognized commercial types of belting. It recommended a program of standard sizes and thicknesses of rubber floor tile which has effected the elimination of several gages and numerous sizes. It effected standardization of rubber soling strips on the basis of 2 sizes instead of the formerly recognized 11 sizes. It also standardized the packing of corrugated matting and running-board material in an effort to reduce manufacturers' remnant losses. This association also simplified the manufacture of transmission belting through the elimination of a particular weight of duck; also adopted minimum tensile strength per inch of ply values for various types of belting duck in an effort to simplify manufacturers purchasing problems. In collaboration with battery manufacturers this association formulated and adopted standard dimensions of offset push-type battery covers with bushings. In cooperation with the National Automobile Chamber of Commerce and the Society of Automotive Engineers, it brought about a standardization and simplification of sizes of balloon tires used as original equipment of new automobiles. It also cooperated with the Federal Specifications Board in the preparation of Federal specifications relating to the testing of radio and automotive rubber battery cases and jars, and in the formulation of new and revision of existing specifications for druggist sundries and mechanical rubber goods. It also cooperated with the American Railway Association in the establishment of specifications for mechanical rubber goods used by railroads. This association assisted various bodies in the textile industry in the preparation of standard specifications for cotton fabrics used by manufacturers of rubberized raincoat materials and rubberized automobile topping. Through the medium of conferences and personal contacts at factories, it undertook the promotion of uniformity of cost-accounting practices among rubberizers. The association has developed an interchangeable or combination tube program to permit

the use of one size tube in two or more sizes of casings. It is now compiling a specification data book which will contain information on standard practices for the mechanical rubber goods industry and will also serve as a guide to mechanical rubber goods manufacturers in advising customers on the proper test methods and values for all types of mechanical rubber goods specifications. The association is officially represented on the following sectional committees: Safety code for walkway surfaces, screw threads for hose couplings (other than fire hose), safety code for rubber machinery, cotton rubber-lined fire hose, aeronautic safety code, and fire-fighting equipment in metal mines.

Sand-Lime Brick Association, Allen G. Walton, president, Box 235, Hummelstown, Dauphin County, Pa. This association in cooperation with a committee of the American Society for Testing Materials recommended that the association's specification for sand-lime brick be changed to conform with the American Society for Testing Materials standard specifications for clay and shale brick, which recommendation was approved and adopted by both organizations. The association sponsored the movement for recommended size of, and quality of sand-lime brick which formed the basis of a simplified practice recommendation, and is now cooperating in the establishment of masonry opening sizes.

Scientific Apparatus Makers of America, J. M. Roberts, secretary-treasurer, 100 North La Salle Street, Chicago, Ill. An important activity of this organization is the standardization of laboratory apparatus, the work being conducted in cooperation with other interested bodies. It has cooperated with the American Chemical Society in standardizing sizes and eliminating obsolete types of chemical apparatus. It is assisting the Surgeon General's Office of the War Department in the formulation of standards and specifications for apparatus used in its laboratories. This organization has also cooperated with the American Society for Testing Materials in checking specifications for apparatus used in testing materials.

Sheet Metal Ware Association. (See Metalware Institute (Inc.), p. 327.)

Silk Association of America (Inc), Ramsay Peugnet, secretary, 468 Fourth Avenue, New York, N. Y. During the past year this association developed and adopted new and re-

vised several existing standard methods. In order to meet current market conditions, it revised its throwing rules, thrown silk rules, arbitration rules, and arbitration submission. For the purpose of facilitating the exchange of credit information, it has formulated and adopted standard financial statement and accountants' verification forms. It has adopted a uniform method for determining weighting in silk fabrics. Further research on this subject is now being conducted by the National Bureau of Standards in cooperation with this association and other interested groups. The association has formulated, but not yet adopted, a standard method of examining finished broad silks. Its sewing silks division has brought about a standardization relating to color range on sewing silks. In an attempt to assist manufacturers in obtaining tints of desired fugitiveness, this association has made available to commission throwsters fugitive dye tints standardized as to color range and tested and certified as fugitive. The association has also formulated a cost-accounting manual for broad silk manufacturers in an effort to standardize the method of figuring costs. The raw silk classification committee has taken part in an international technical raw silk conference composed of representatives of the seven major silk producing and consuming countries, to further the universal adoption of the raw silk classification. A color coordination committee has been appointed by the association to cooperate with retail dress and other allied industries for standardizing seasonal colors. A standard definition for grenadine yarn has been adopted by the board of managers of the association. A committee has also been appointed to study economic and research problems of the silk industry. The association is officially represented on the sectional committees on safety code for textiles and standardization of speeds of machinery.

Simplex Concrete Pile Association (Inc.), W. M. B. Freeman, secretary, 38 Chauncey Street, Boston, Mass. Standard specifications for simplex concrete piles have been issued by this association. These specifications cover material, dimensions, capacity, spacing, driving form, reinforcement, driving methods, and basis of contract.

Society of Automotive Engineers (Inc.), John A. C. Warner, secretary and general manager, 29 West Thirty-

ninth Street, New York, N. Y. Approved standards are published as the society's specifications in the society's handbook which is revised and published in February of each year. Standards adopted semiannually each June are published in a supplement to the handbook and incorporated in the next edition. In the present edition there are more than 600 specifications. In 1930, 42 new and revised standards were adopted. Specifications adopted for airplane parts and materials include the following: Airplane propeller hubs and shaft ends, airplane engine starter mountings, airplane wheel rims, control pulleys and stream line and internal tie rods. General new and revised automotive specifications adopted were: Annular ball and roller bearings, metric spark plugs, aluminum alloys, definitions of heat treatment for steels, laboratory test specifications for motor vehicle head lamps, tail lamps, and signal lamps, tail lamp construction details, license plate brackets, viscosity numbers for crankcase lubricating oils, electric incandescent lamps for motor boats, automobile body type nomenclature, Woodruff key slot cutters and gages, taps, slotted head cap and machine screws, wood screws and balloon tires. In addition to these, the 1930 edition of the handbook contains general information on protective coatings for aluminum, chromium plating and die materials and rare metals. International agreement is being approached on the standardization of annular ball bearings and progress is being made on other types. In the electrical field research is in progress on developing approved specifications for insulation and high-tension ignition cable. In addition to a considerable number of important aeronautical standardization projects, an extensive investigation by a specially selected committee of lighting equipment requirements on airplanes, particularly landing lights, is making good progress. New or revised specifications are being developed on extruded aluminum alloy shapes, countersunk head aluminum alloy rivets, stream-line tubing shapes, aircraft tubing sizes, shock absorber struts, fire-extinguisher brackets, fuel valves, hose and hose liners, hose nipples, tank flanges, tube clips, propeller hub cones and nuts, and wood propeller hubs. Further automotive specifications are being developed for Diesel-engine parts and materials such as engine-testing forms, fuel-pump mount-

ings, fuel nozzle connections, glow plugs, connecting-rod bolts, shaft ends and couplings; also in the gasoline automobile field for fuel pump drives and radiator tests. Committees are working on heat treatments for S. A. E. steels, the development of physical property charts for steel, headlamp mountings, outboard-motor specifications, brass and copper alloys, window-glass channels and spline fittings. Together with the American Petroleum Institute and the National Automobile Chamber of Commerce, the Society of Automotive Engineers maintains a staff of research associates at the National 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 research is conducted under the auspices of a cooperative steering committee composed of representatives of the four organizations. In addition, the bureau is cooperating with the department of psychology of George Washington University in a study of fatigue incident to automobile travel. This work is being conducted under the auspices of the society with funds provided by representative companies in the industry. The society initiated the movement for the reduction of number of sizes of automobile brake linings and roller bearings which resulted in the formulation of simplified practice recommendations relating to these items. The society acts in an advisory capacity on the cooperative committee on motor-truck impact tests. Under the auspices of this committee the United States Bureau of Public Roads has been conducting truck impact tests. The National 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 several months under the direction of the society. Advertising in the society's handbook is limited to the suppliers of automotive parts or materials made in accordance with the society's specifications, certificates being signed by proper officials of the manufacturing firms to the effect that the products advertised comply with the

designated specifications. Information concerning these specifications and their promulgation is supplied through: The society's handbook (issued annually, with a semiannual supplement); the Society of Automotive Engineers Journal (monthly); direct circularizing; correspondence; the trade press; and in meetings. The society is a sponsor or joint sponsor for 10 sectional committees dealing with the following projects: Aeronautical safety code; ball bearings; bolt, nut, and rivet proportions; motor-vehicle lighting specifications; machine pins; plain and spring washers; screw-thread standardization; small tools and machine-tool elements; transmission chains and sprockets; wire and sheet-metal gaging systems. During 1930 the society was represented on about 35 committees or boards of other national organizations or governmental bureaus and departments.

Society for Electrical Development (Inc.), J. Smieton, Jr., secretary, 420 Lexington Avenue, New York, N. Y. This society has promulgated a model uniform electrical ordinance to provide a guide for drawing up municipal regulations for installation of electrical wiring equipment. It has also formulated the Franklin specifications for good lighting which provides for a simple, direct method for laying out the general lighting of factories, stores, offices, public buildings, and other non-residential interiors. The society has inaugurated a so-called red seal plan for identifying a house that is properly and adequately wired. The plan involves wiring specifications, inspection, and award. 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 specification, 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. Several of the society's committees are engaged in the following standardization projects: Time study engineering; production standards; plant maintenance standards; and management terminology. The society is officially represented on sectional committees on safety codes for conveyors and con-

veying machinery and table of preferred numbers.

Society of Motion-Picture Engineers, Arthur C. Hardy, chairman, standards committee, care of Massachusetts Institute of Technology, Cambridge, Mass. The standardization work of this society is carried on by its standards committee which at present is divided into four subcommittees. This association has adopted dimensional standards for cutting, splicing, and perforating motion-picture films and for the apertures, projection lens diameters, and sprockets for motion-picture projectors. It has also adopted a recommended practice for the taking and projection of motion pictures which has been approved by the American Standards Association. The standards committee is now engaged in the following activities: Standardization of a new width for motion-picture film, revision of the glossary of terms and the compilation of a list of the foreign equivalents of such terms, preparation of a report concerning certain items of recommended practice in connection with the production and processing of motion-picture films, and the development of a safety code for the handling of motion-picture films.

Society of Naval Architects and Marine Engineers, Daniel H. Cox, secretary-treasurer, 29 West Thirty-ninth Street, New York, N. Y. This association cooperates with the American Marine Standards Committee in the formulation and adoption of marine standards. It is joint sponsor with the American Society of Civil Engineers and the Association of American Steel Manufacturers for the sectional committee for structural steel shapes, and is officially represented on 15 additional sectional committees.

Society for the Promotion of Engineering Education, F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa. Standardization as applied to the teaching of engineering subjects is one of the functions of this society. Its work is carried on under the auspices of the American Standards Association. It is serving as joint sponsor for two sectional committees, as follows: Scientific engineering symbols and abbreviations (with four other organizations), and standards for drawings and drafting-room practice (with the American Society of Mechanical Engineers).

Society of Terminal Engineers, Charles H. Newman, secretary, 30 Broad Street, New York, N. Y. The

society's standardization work is conducted through representation on committees of other national organizations. It is represented on a committee organized by the American Society of Mechanical Engineers for research on the properties and life of wire rope. It is also officially represented on three sectional committees dealing with safety codes for elevators and escalators, conveyors and conveying machinery, and on cranes, derricks, and hoists.

Southern Cypress Manufacturers' Association, J. R. Black, secretary-manager, Jacksonville, Fla. The standard grades and classifications for cypress lumber and shingles adopted by this association are the recognized rules for the grading of cypress in the lumber industry. Through its committee on grades and specifications, all of the association's rules have been revised to conform to American lumber standards. Under strict supervision of the inspection department, every effort possible is made to insure that lumber manufactured by the association's member mills is graded and shipped in accordance with American lumber standards. Under proper inspection, member mills are permitted to stamp their lumber with the association's trademark, which has the approval and backing of the association.

Southern Hardware Jobbers Association, S. St. J. Eshleman, secretary-treasurer, 704 New Orleans Bank Building, New Orleans, La. The simplified practice recommendation on varieties and sizes of loaded paper shot shells was prepared through the joint cooperation of committees of this association, the National Hardware Association of the United States, and the National Retail Hardware Association.

Southern Pine Association, H. C. Berckes, secretary-manager, New Orleans, La. Standard specifications for grades of long-leaf and short-leaf southern pine lumber, dense long-leaf and short-leaf southern yellow pine timbers, bridge and trestle timbers for railway structures, and Gulf Coast classification of pitch pine have been adopted by this association. Its grading rules have been revised to conform to American lumber standards, and the association employs a staff of inspectors who make a monthly check on the member mills to determine whether or not lumber is being manufactured in accordance with the provisions adopted by the central com-

mittee on lumber standards. Firms receiving this service are permitted to place the association grade and trademark on all of the lumber they manufacture. This association has incorporated into its grading rules definite moisture specifications relating to percentages governing both common and select lumber, which will insure to consumers that lumber placed on the market is in properly seasoned condition. The association is officially represented on the sectional committee on specifications for cross ties and switches.

Southern Sash, Door, and Millwork Manufacturers Association. C. B. Harman, secretary, Forsythe Building, Atlanta, Ga. Standard methods for millwork cost-accounting; standard specifications of manufacture; and standard sizes, grades, and designs for sashes, doors, and millwork have been formulated by this association.

Southern Supply and Machinery Distributors' Association. Alvin M. Smith, secretary-treasurer, care of Smith-Courtney Co., Richmond, Va. This association cooperated in the formulation of the simplified practice recommendation for hack-saw blades, and took an active part in the standardization of wrought-iron and wrought-steel pipe, valves and fittings, and the packing of carriage, machine, and lag bolts. It is officially represented on the sectional committee on standardization of gears.

Standard Container Manufacturers. Russell W. Bennett, secretary-manager, Realty Building, Jacksonville, Fla. This association, successor to the Southern Crate Manufacturers Association, was originally organized in 1913 as the Southeastern Package Club with members enrolled from South Carolina, Georgia, Florida, and Alabama. Some of its stated objects are the promotion of uniform customs and usages among manufacturers, the investigation of modern economies in manufacture, and the promotion of legislation for uniform standards for all fruit and vegetable packages. It has adopted standard-size containers for the packaging for shipment of fresh fruits and vegetables. These standards conform to the fresh fruits and vegetables and loading rules of the Interstate Commerce Commission. This organization was officially represented on the United States Department of Commerce Advisory Board on Domestic Packing, and is now cooperating in the activities of the Bureau of Agricultural Economics of the

United States Department of Agriculture, Florida State marketing bureau, Freight Container Bureau of the American Railway Association, Southern Freight Association and representative organizations of growers and shippers in standardization and simplification matters.

Steel Barrel Manufacturers Institute. D. S. Hunter, secretary-treasurer, Keith Building, Cleveland, Ohio. The simplified practice recommendation on sizes of steel barrels and drums was sponsored and adopted by this institute. Among other standards which it adopted are those for steel barrels which were established by the Interstate Commerce Commission and the Consolidated Freight Classification Committee; also thread dimensions for spuds and plugs, distances between rolling hoops, and weights of barrels of various types and sizes.

Steel Founders Society of America. Granville P. Rogers, managing director, 420 Lexington Avenue, New York, N. Y. During the past year this association published a booklet containing the standard trade customs adopted by the society to be used by buyers and producers of steel castings. In addition, it adopted the standard sales contract and order acceptance and quotation sheet for the purpose of simplifying transactions between steel foundries and their customers. The society cooperated in the preparation of the simplified practice recommendation for malleable foundry refractories and with the American Society for Testing Materials in the formulation of steel castings specifications. It cooperated, through representation on committees of other societies, in the development of specifications and standards affecting the steel foundry industry. The society conducted tests to assist in the revision of the national safety code pertaining to use and care of abrasive wheels.

Structural Clay Tile Association. Edward C. Kerth, secretary, Engineering Building, Chicago, Ill. This association is successor to the Hollow Building Tile Association and has associated with it not only American, but Canadian and Mexican members. Co-operating with the Federal Government departments it has issued the following standards: Compressive and transverse strength of hollow tile walls, transmission and absorption of sound by some building materials, tests on hollow tile and concrete slabs reinforced in one direction, recommended minimum requirements for

masonry wall construction, recommended practice for arrangement of building codes, and recommended requirements for small dwelling construction. In cooperation with the National Bureau of Standards this association has evolved standards for the manufacture, use, and application of tile, through the determination of its properties and characteristics. The standards as set up by the Government agencies were followed by the association in cooperation with other testing laboratories throughout the country. This association was also one of the first to adopt the simplified practice recommendation for hollow building tile, which was formulated in cooperation with the standards committee of this organization and the division of simplified practice. The association is carrying on a constant program of experimental and research work in various authoritative institutions and maintains a continuous contact with the various Government research agencies.

Tap and Die Institute, Herbert S. Blake, secretary-counsel, 74 Trinity Place, New York, N. Y. Elimination from catalogue lists of sizes and styles of taps and dies, and the establishment of proper standard basic mechanical sizes of these tools are the principal activities of the committee on simplification and standardization of this institute. It is officially represented on sectional committees on screw threads for bolts, machine screws, nuts and commercially tapped holes, and on screw threads for rigid electrical conduits.

Technical Association of the Pulp and Paper Industry, R. G. Macdonald, secretary, 18 East Forty-first Street, New York, N. Y. This association has adopted officially 28 methods of testing paper which were formulated in cooperation with the National Bureau of Standards. Additional methods are being developed at the present time. The association is cooperating with the American Standards Association and the American Society for Testing Materials with respect to the testing of paper and roofing. It is officially represented on the sectional committee on identification of piping systems.

Technical Institute of the Biscuit and Cracker Manufacturers' Association, A. A. Schaal, director, 816 Superior Boulevard, Minneapolis, Minn. For the past several years this institute has been engaged in formulating standards and specifications for raw materials going into biscuit and

cracker production. It has already adopted tentative specifications for many raw materials and is endeavoring to raise the standard of finished biscuits and crackers. With reference to standards for finished products, the institute has been successful, through yearly training conferences, in raising the quality in general of several pieces, such as the vanilla wafer, the soda cracker, and others. During the past few years various plants have adopted certain standards relating to size, color, texture, grain, and other characteristics on a number of pieces which the institute is planning to make universal in an attempt to raise the general quality of production.

Telephone Group. Representatives of the Bell Telephone System and the United States Independent Telephone Association comprise the membership of this group. The American Standards Association secretary of the group is H. L. Huber of the American Telephone & Telegraph Co., 195 Broadway, New York, N. Y. This group is now assisting in the preparation of 17 standards under the procedure of the American Standards Association. Additional standardization work is carried on through representation of various committees cooperating with regulatory bodies such as State commissions, national, and international bureaus. It also participates in committee work of various engineering societies. 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 different phases of communication, including outside plant, inside plant, electrolysis protection, transmission development, and radio and wire carrier systems. The 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 has for its primary object the promotion of color and its correlation in every related branch of industry. It formulated the standard color card of America showing 192 staple shades, as well as seasonal color cards, which are being widely used in the textile and allied industries both in this country

and abroad. Each spring and fall of the year cards are issued for the textile industries including silks, woolens, millinery, shoe and leather, hosiery, and related trades. The United States Army color card showing the official colors for arms and services and approved and accepted by the Quartermaster General of the United States Army has also been a development of this association. The colors on all cards are identified by standard names which never change as well as by cable numbers, thus insuring an exact color interpretation. An index is brought out each season listing the names and numbers of all colors appearing on cards issued since the founding of the association in 1915. The association cooperates with leading textile, millinery, leather, hosiery, garment, and kindred industrial trade association groups, in the selection of basic shades.

Textile Converters' Association, Samuel M. Fisher, secretary, 291 Broadway, New York, N. Y. This association, formerly known as the Converter's Association, has adopted a standard terminology of the phrase "double cuts" when used in connection with the purchase and sale of gray goods. It has also adopted a standard method to be employed by the finishers of cotton fabrics—the return by the finishers to the converter of all stretch as well as damaged goods, and remnants of finished merchandise over 1 yard in length. This principle has been established as a standard of conduct for the trade. A joint committee composed of representatives of the gray goods contracts committee of this organization and representatives of the Association of Cotton Textile Merchants of New York is now engaged in the following additional standardization work: More accurate limitations to the use of the word "seconds" as applied to cotton; establishing a standard definition of the term "no lighter than" when used in connection with gray goods and the permissible variations in weights; standardizing procedure in the use of oil remover and the character of the oil remover used; the proper proportion of "seconds," if any, which should be permitted under an order for "firsts"; establishing a uniform gray-goods sales note which should prove equitable to seller and buyer alike.

Tire and Rim Association (Inc.), C. E. Bonnett, general manager, 1401 Guarantee Title Building, Cleveland, Ohio. This association is attempting to reduce the number of sizes in tire

and rim equipment. It has formulated and adopted standards for rims, valves, bands, and solid and balloon tires for passenger cars, airplanes, and motor cycles. It cooperated in the establishment of the simplified practice recommendation relating to sizes of industrial truck tires which have also been adopted by this association.

Underwriters' Laboratories, Dana Pierce, president, 207 East Ohio Street, Chicago, Ill. These laboratories are maintained by the National Board of Fire Underwriters for testing and inspecting appliances and devices upon which reports are issued to insurance organizations. This organization has already issued over 120 standards and specifications for electrical devices and miscellaneous materials with relation to life and fire hazards, theft, and accident prevention. During the past year it either prepared or revised standards for: Armored cables and armored cords, bandit-resisting inclosures, concrete blocks, domestic electric ranges, electric motors for Class I locations, electric motors for use in hazardous atmospheres, electric signs, electrically heated appliances, flexible nonmetallic tubing, gas systems for protection of vaults against burglary, hand operated discharge devices, heat resisting fixture wire and flexible cord, outside visible measure discharge devices, motor-operated discharge devices, motor-operated pumps and discharge device accessory pumps, power operated radio receiving sets, rubber-lined hose, safety cans for the storage and handling of hazardous liquids, soldering lugs, sound recording and reproducing equipment, therapeutic carbon arc lamps, unlined hose, valves for hazardous liquids, and window cleaners anchors. The standards for electric motors for use in hazardous atmospheres and Class I locations have been prepared in cooperation with the National Electrical Manufacturers Association. Arrangements are made with manufacturers for the inspection of devices and materials at the factories by laboratory inspectors, and standard goods are identified by stamps, transfers, labels, or other markings. The burglar protection department is working on methods and devices, including burglar alarm systems, for the protection of buildings, safes, vaults, banks, and storage containers. As a member of the Fire Protection Group of the American Standards Association, this organization served as joint sponsor (within the American Society for Test-

ing Materials and the National Bureau of Standards) for specifications for the fire tests of materials and construction, and (with the American Society for Testing Materials) for specifications for rubber-lined fire hose. It is officially represented on 28 additional sectional committees.

United Roofing Contractors Association of North America, E. M. Pope, secretary, 58 West Washington Street, Chicago, Ill. Two specifications relating to gravel or slag roofing for use over board sheathing and over concrete have been formulated by this association and recommended to its members for use in the construction of built-up roofs. This association permits manufacturers to use its trade mark label on materials inspected and found to comply with its specifications.

United States Feed Distributors Association. (See Grain and Feed Dealers National Association, p. 319.)

United States Pharmacopœia Convention, Lewis E. Warren, secretary, 2 Raymond Street, Chevy Chase, Md. Through its committee on revision, this organization revises the Pharmacopœia of the United States of America at intervals of 10 years, the last revision having become effective January 1, 1926. The last decennial meeting of the convention was held in Washington, D. C., in May, 1930. In addition to the election of a president and other officers, a new committee on revision, consisting of 51 members, was appointed. General principles for the guidance of the committee were adopted by the convention. The committee on revision is now actively engaged in revising the pharmacopœia, which describes and gives standards for such drugs as are given official status by the medical profession. It is recognized as authority by the national food and drug act of June 30, 1906, and similar laws of many States in the Union.

United States Potters Association, Charles F. Goodwin, secretary, East Liverpool, Ohio. Committees of this association are studying the question of establishing uniform shop conditions and practices and in various phases of pottery manufacture. The association's research committee cooperates with the National Bureau of Standards and other laboratories and institutions in its work on feldspars, clay, glaze fit, fineness of flint and spar, and standard test methods.

United States Shellac Importers Association (Inc.), L. W. Babbage, secretary, 17 State Street, New York,

N. Y. In cooperation with the American Bleached Shellac Manufacturers Association, this organization has formulated standard methods of analysis and specifications for both bleached and orange shellac. It has adopted standard rules and regulations governing the sampling, analysis, allowances and penalties, and weights of shellac. This association has also adopted standards for the principal commercial grades and net weights of packages of shellac which form the basis for practically all transaction with India and locally. During the past year it adopted new rules governing allowances and penalties and examination of shellac on arrival from India. The purpose of these new rules is to raise the quality of deliveries. The association maintains in the Polytechnic Institute of Brooklyn, N. Y., a research bureau, the function of which is to deal with problems arising concerning the uses of shellac.

United Typothetæ of America, John J. Deviny, secretary, Tower Building, Washington, D. C. This organization cooperated in the formulation of the simplified practice recommendation for grades and sizes of paper. It has established the following standards which are now in use in the industry: Specification and estimate forms, classifications of accounts, balance sheet and operating statement, and cost-finding system. In order to assist printers in their work, this organization has published a dictionary containing standard graphic art terms.

Wallpaper Association of the United States, E. D. Belknap, executive vice president, 10 East Fortieth Street, New York, N. Y. Representatives of the wall paper industry cooperating with this association assisted in the establishment of the commercial standard for grading and testing wall paper. During the past year this association has revised its code of trade practices relating to misbranding, fraud, and misrepresentation, and imitation of trade-marks or trade names, and trade regulations with respect to width, length, and permanency of color of wall paper. The association has copyrighted a self-identifying trade-mark guaranteeing compliance of the wall paper upon which it is printed with the requirements of the commercial standard for this commodity.

Webbing Manufacturers' Exchange, Wilwyn Herbert, secretary, 74 Trinity Place, New York, N. Y. Grading rules relating to the number of cuts

or pieces permitted in first quality goods, such as webs made on looms running only one strip at a time and products made on looms running a number of pieces at one time, have been adopted by the exchange. It co-operated in the formulation of the simplified practice recommendation on standard sizes of shoe gores. In co-operation with the Corset and Brassière Association, the exchange has also adopted a standard of minimum sizes of rubber thread for use in the webbing industry.

West Coast Lumbermen's Association. W. B. Greeley, secretary-manager, Stuart Building, Seattle, Wash. The official standard grading and dressing rules of this association for Douglas fir, Sitka spruce, West Coast hemlock, and western red cedar lumber are in conformity with the American lumber standard sizes and grades promulgated by the industry under the auspices of the Central Committee on Lumber Standards and published as simplified practice recommendation No. 16. It has also adopted standard grades for architectural woodwork. The rules of this association are now widely distributed among manufacturers, wholesalers, retailers, and others engaged in the various branches of the construction industry. Through its department of grades and manufacture, this association makes monthly inspections at member plants and issues official certificates of grade and quantity of individual shipment upon request; it reinspects at point of destination, followed by the issuance of a detailed report; and it provides for and supervises the use of official grade and trade-marks at member plants. This association supplies a standard shipper's certificate to its members who desire to use them in their shipments. This form certifies as to the exact quantity by pieces or fit and quality of lumber loaded. In order to eliminate present confusion in molding design, the association cooperated with interested regional lumber associations and millwork manufacturers in the formulation of a single national standard for the manufacture of molding which has been approved by this association and other bodies. During the past year this association developed standards for the manufacture of interior millwork which are now employed by western Oregon and Washington manufacturers. These standards are incorporated in a pamphlet entitled "Standard Architectural Woodwork and Select Architectural

Woodwork" and have been approved by local architects who are now using them in connection with the preparation of building specifications. The association is officially represented on sectional committees on specifications for crossties and switchties and specifications for methods for testing wood.

Western Pine Manufacturers Association. S. V. Fullaway, jr., secretary-manager, 510 Yeon Building, Portland, Ore. Cutting dimensions for standard fresh fruit and vegetable containers, established by this organization, are contained in "Westpine Box and Crate Specifications List No. 2." It has issued another publication containing standard rules for grading pondosa, sugar, California and Idaho white pine, larch, Douglas fir, white fir, spruce, and cedar lumber. This book was published jointly by this association and the California White and Sugar Pine Manufacturers Association.

Western Red Cedar Association. W. H. Jones, secretary, 344 Peyton Building, Spokane, Wash. Official specifications formulated and adopted by this association include those for split and round cedar posts, poles, and piling. During the past year, this organization revised its specifications for butt-treating cedar poles in open tanks. Several of its members are serving on committees of the American Wood-Preservers' Association. The association is officially represented on the sectional committee on specifications for wood poles.

Wirebound Box Manufacturers Association. R. M. McClure, secretary, 111 West Washington Street, Chicago, Ill. This association aided in the establishment of the simplified practice recommendation for sizes of rotary-cut lumber for wire-bound boxes. The standardization and specifications committee of the association is conducting tests of wire-bound boxes and designing new packages. In addition, it is undertaking tests of new forms of wire-bound boxes covering various veneer thicknesses, positioning of staples, and placing binding wires. It cooperated with the Bureau of Explosives in the development of new general specifications for wire-bound shipping containers for the transportation of explosives and other dangerous articles. It cooperated also with the Federal Specifications Board in the preparation of specifications for all common styles of wooden wire-bound boxes. These specifications have been approved by the industry and are now

awaiting definite action by the Government.

Wool Institute (Inc.), A. D. Whiteside, president, 2 Park Avenue, New York, N. Y. This institute has formulated and adopted standard wool tops in cooperation with the United States Department of Agriculture. Committees of the institute are working for the establishment of additional standards relating to fabrics and other materials manufactured in the wool industry.

Writing Paper Manufacturers Association, E. H. Naylor, secretary-treasurer, 95 State Street, Springfield, Mass. "Trade Customs" is the title of a booklet issued by this association. It contains a table showing revised weights to conform to the 1,000-sheet standard unit, which are to be marked on packages of bonds and linens, flat writings, and ledger papers made to specifications. Other items of trade

customs covered in this booklet are: Special sizes, special colors, over runs and under runs, broken packages, claims, water marks, small sizes, light weights, and terms of sale. The price, size, weight, weight variation, and packing methods in regard to index and mill bristols which have been adopted by the Writing Paper Manufacturers Association and the book paper manufacturers are also included in the booklet.

Wrought Iron Research Association, Stanley P. Watkins, metallurgist, 1111 Union Bank Building, Pittsburgh, Pa. This association's work in standardization is conducted by a committee of the American Society for Testing Materials on which the association maintains official representation. During the past year this committee revised the specifications for iron which have been adopted by the association.

IX. BIBLIOGRAPHY ON STANDARDIZATION

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