AMERICAN HOROLOGICAL INDUSTRY

HEARING

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON ARMED SERVICES UNITED STATES SENATE

EIGHTY-EIGHTH CONGRESS

SECOND SESSION

ON

IMPORTANCE OF AMERICAN HOROLOGICAL INDUSTRY TO THE NATIONAL DEFENSE

AUGUST 17, 1964

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IMPORTANCE OF AMERICAN HOROLOGICAL INDUSTRY TO THE NATIONAL DEFENSE

MONDAY, AUGUST 17, 1964

U.S. SENATE,
SUBCOMMITTEE OF THE
COMMITTEE ON ARMED SERVICES,
Washington, D.C.

The special subcommittee appointed to consider the question of the importance of the domestic horological industry to national defense (composed of Senators Symington (chairman), Jackson, Thurmond, Saltonstall, and Smith), met, pursuant to notice, at 10 a.m., in room 212, Old Senate Office Building, Senator Stuart Symington, presiding.

Present: Senators Symington, Jackson, Thurmond, Saltonstall, and Smith.

Also present: Senator Stennis.

Also present: T. Edward Braswell, professional staff member; Charles B. Kirbow, chief clerk; Herbert S. Atkinson, assistant chief clerk.

Senator STENNIS. Come to order, please.

I just wish to make an announcement here for the record. A special subcommittee composed of Senator Symington, Senator Jackson, Senator Thurmond, Senator Saltonstall and Senator Smith was appointed and asked to conduct a hearing with reference to this special subject matter. Senator Goldwater and I will not be members of the subcommittee and will not be connected with the hearings.

I am unable to be here myself, and have asked the Senators that I have named, to serve as this special subcommittee.

I have so many other matters, including appropriations and armed services matters, and conferences, that I am not going to be able to serve on this subcommittee.

I was a member of the subcommittee that considered this matter 10 years ago and remember those hearings. This is still an important question. Some say it is as important as it was then, some say it is not—I don't know. I am not passing on that.

I just wanted to make this statement for the record.

Senator Symington will be chairman.

Mr. Braswell of the full committee will be the staff member, and that was arranged with Senator Russell.

(Short recess.)

Senator SYMINGTON. The hearing will come to order.

The subcommittee is meeting today for the purpose of hearing testimony on the matter of the importance of the American horological industry to national defense.

It may be recalled that 10 years ago the Preparedness Subcommittee No. 6, consisting of Senator Duff (chairman), Senator Stennis, and Senator Cooper, issued a report concluding that it was essential to the national interest that this industry be kept alive and vital.

We all know that the watch industry, in this missile age, is playing an important role in producing vital precision instruments and components for the missile and space program. It is therefore timely that the importance of this industry be reviewed.

The Chair wishes to emphasize that the question before the subcommittee is limited to the vitality of the domestic watch industry as it relates to our national defense program. Our scope does not involve some of the other equally broad questions that may be involved in the matter of increasing or decreasing the tariffs on the importation of watches.

As our first witness today we are indeed fortunate to have with us Gen. Omar Bradley, a great son of my own State of Missouri, and one of the finest military leaders this Nation has ever produced. For the past 6 years General Bradley has served as chairman of the board of the Bulova Watch Co.

General Bradley, as I understand it, you have a prepared statement, sir.

General BRADLEY. Yes, sir; I have, Mr. Chairman—if I may read it. May I ask if you have a copy in front of you so you can follow it?

Senator SYMINGTON. Yes, I have a copy here.

STATEMENT OF GEN. OMAR BRADLEY, CHAIRMAN, BULOVA WATCH CO.

General BRADLEY. Mr. Chairman, Members of the committee, on behalf of the domestic watch industry, and as chairman of the Bulova Watch Co., I wish to express our appreciation for the invitation we have received to testify here today.

My remarks today will, in part, be a condensation of a more complete written statement which I have prepared and which, with the subcommittee's permission, I should like to have included in the printed record of these hearings.

After my general remarks on the domestic watchmaking industry, representatives of each company will tell you in more detail what their respective companies are doing.

It was 10 years ago that a special subcommittee of the Preparedness Investigating Subcommittee made a detailed investigation of the importance to national defense of the domestic horological industry. At the conclusion of those 1954 hearings, the committee said, among other things:

> The highly skilled workers in the American watch and clock industry, who require long years of training and experience, and their unique ability to develop and produce, within the shortest time possible, precision instruments to minute tolerances, are essential to the national defense. Therefore it is in the interest of national defense to keep this essential industry alive and vital.

In the course of your 1954 hearings, you received testimony from many sources and from many individuals, both public and private. Included in this testimony was that offered on behalf of the Department of Defense, in which the Assistant Secretary of Defense testified, among other things, that:

I wish to reaffirm the vital essentiality of the horological industry for defense.

To this, the Assistant Secretary of Defense added:

If any measures to sustain domestic production can be devised that will apply equitably to the entire horological industry, the Department of Defense would endorse them as assisting to maintain an important part of the mobilization base.

Four years later, in 1958, the Office of Defense Mobilization reached a conclusion that was, in some respects, contrary to the conclusion it had reached, and the testimony given, in 1954. While we disagreed at the time, and still disagree today, with ODM's 1958 conclusions, and while we disagreed then, and still disagree today, with the premises on which those conclusions rested, it is not our intention at today's hearing before this subcommittee to debate the correctness or incorrectness of ODM's 1958 report. It seems to me that the real question now, both in terms of your subcommittee's interest and in terms of our industry, under the quite different facts of 1964, is the nature and degree of the importance of the American horological industry to our national interest. This includes both the national defense contributions of the industry and the many other important contributions which the industry is making today and will be called on to make in the difficult years to come.

The domestic industry's contributions to national defense, space technology, and other vital national interest programs are at least as significant today as they have been in the past—and we believe will become even more so as the complicated, miniaturized, high-precision items needed in these programs become ever more sophisticated. In the past few years, the domestic watch producers have assumed an important role in designing, developing, and supplying critical timing devices for the new weapons, particularly missiles, while continuing to supply items for conventional weapons. The exacting demands for quality and reliability in miniaturization and precision become greater every year.

Witnesses from the respective companies will give you examples of how the watchmaking know-how of each company is currently serving the national interest. Although the end items we are working on may be quite different, they all depend upon a single ingredient in common; namely, the existence of a watchmaking organization, in being, with a combination of skills and facilities that no other single American industry possesses at this time. This combination includes specialized production facilities and highly trained personnel who deal on a day-to-day basis with problems of design, engineering, and mass production of miniature timing devices to microscopic tolerances and highest possible quality and reliability.

An integral part of this production capacity for such devices is the research, design, and engineering skills which have enabled these companies to solve problems brought to them by the services, by other Government agencies, and indeed by other industries.

To be sure, some of the ingredients that make up these horological organizations may be found in other industries. Other companies, such as the ball bearing industry, work to very close tolerances. Other companies make timing devices for parking meters, washing machines, etc. Other companies have some of the machines used by the watch industry, such as screw machines (although they do not have certain specialized machines which are unique to the horological industry). Others, such as electronic companies, do very fine work on miniaturized components. But no other industry has the unique combination, in being, of the R. & D., engineering and production skills, equipment and know-how to do all these things within the same organization, to the same degree of perfection, and in the shortest possible time.

This element of time is of course critical. Given unlimited time and resources, I have no doubt that other companies could develop the combination of skills and know-how possessed by the domestic watch manufacturers. However, it took Bulova more than 15 years to develop its present fully integrated watchmaking capability in this country. And, as found by the subcommitteee in 1954, it takes 10 years or more to train some of the highly skilled tool and die makers in a watch plant.

I am sure this subcommittee has heard, and will hear, assertions that other companies can do anything the watch companies can do. I respectfully submit that such glib assertion ignores the following facts:

(1) It ignores the unique combination of skills and other resources, in being, possessed by watch companies, and only by watch companies.

(2) It ignores the element of time, the extensive and (from a military standpoint, the potentially disastrous) leadtime, that companies not in the horological industry would need to develop and perfect the skills, equipment, and machinery which watch companies have been utilizing daily as a routine part of their operations for many years.

(3) It ignores the many instances where the services, or other Government agencies, or other manufacturers, have come to the watch industry to solve design, engineering, or production problems which nonwatch companies had been unable to solve. Specific examples of this will be covered by other witnesses.

I would submit further that those who assert that others can do anything watch companies can do, whether they realize it or not, are doing this country a grave disservice. Other countries, such as Russia, Germany, France, Great Britain, and Japan—to say nothing of Switzerland itself—have determined that a domestic watch industry is necessary in their own national interest; and their governments have taken positive steps to keep these industries alive and healthy.

I expect that representatives of companies who are 100 percent importers will stress several points in their attempt to show that we are not necessary for national defense.

1. They will quote the 1958 findings of ODM.
2. They may say that our domestic industry is nonprogressive and inefficient.
3. They may say that a reduction of tariffs will not hurt the domestic producers.
4. They may tell you that the importers can make defense items too.
5. They may say that some nonwatch companies can do anything watch companies can do.

This last point I have already covered. The others, I discuss more fully in my written statement, but briefly I might say, first, that the premises upon which the 1958 findings were made are no longer valid as of today, 1964. Furthermore, as the name implies, the Office of Defense Mobilization was concerned in 1958 primarily with what happens during mobilization after an emergency occurs. It is my belief that we are more concerned today with improvement of weapons now, so that our strength and state of preparedness will prevent such an emergency.

Second, the two most significant advances in watches in this century—the electric and electronic watches—have been made by American companies. As far as efficiency is concerned, the American companies are fully as efficient as Swiss companies, if not even more so. We know because Bulova owns and operates factories in both countries.

Third, we are fully aware of our costs in both countries, with U.S. labor rates almost three times what we pay in Switzerland. Even at present duty rates, we are already approaching the minimum number of watch movements we can manufacture profitably in the United States.

Fourth, we recognize that the importers can make certain defense items; but with parts of foreign manufacture—which would be cut off in any emergency—their watchmaking capabilities and technology do not begin to compare with those of the integrated domestic producers.

They may also tell you that the watch companies do not need to make watches in order to make their contribution to defense items—that they can convert 100 percent to defense work. That is just not so.

In the first place, it is the day-to-day work that maintains the arts and skills of watch manufacturers. After a short time, this would be lost, and with no further watch production in sight, no new people would enter the trade. Furthermore, no manufacturing facility can exist very long on defense work alone. The allowable margin of profit is too small, and projects and work do not come in a sufficiently steady flow.

Our own domestic industry, the jeweled-lever segment, is now down to having only 14 percent of the U.S. market—the rest is supplied by imports. Since the hearing before this subcommittee 10 years ago, Waltham has disappeared, and two of the pin-lever companies have abandoned domestic production of wristwatches.

Even so, the Swiss and the importers are not satisfied. They are seeking before the Tariff Commission to secure a substantial reduction in duties. Why? The Swiss economy is already so prosperous that it is practically at the bursting point, and they are producing watches at absolute capacity, with a large segment of imported labor.

The reason is a simple one. What they really want is to eliminate the technological capability of our industry in the United States. The Swiss realize that this technological capability was responsible for developing and producing the two major horological innovations of this century—the electric and electronic watches—and they seek to make sure that this technological ability is choked off. If they are successful in their endeavor, imports will take over 100 percent of the U.S. domestic market—and the United States will end up as the only major power with no jeweled-lever watch industry available for defense purposes.

At today's hearing, testimony will be offered by the three remaining companies that make up all that is left of the jeweled watch industry in the United States. Mr. Arthur Sinkler, chairman and president of the Hamilton Watch Co., and Mr. Henry Margolis, president of the Elgin National Watch Co., will describe for you some of the vitally important work which their companies are being called upon to perform both in missilery and in space technology. Mr. George Fraker, vice president of General Time Corp., will similarly address himself to the work of his company in these and related fields. Later on, I shall address myself more specifically to the similar contributions of the Bulova Watch Co.

We also have with us today executives of Bulova, Elgin, and Hamilton from the technical sides of our respective operations. They will be available throughout this hearing to answer any questions which members of the subcommittee may have. They are also available to describe the highly advanced work which the horological industry is currently doing, in missilery, in space technology, and in other fields. They have with them models and mockups showing how the work and skills of the horological industry tie in directly to the national defense and other national interest work which the industry is constantly being called upon to perform. In addition, if the subcommittee so desires, they are prepared to testify in executive session at the conclusion of this hearing on a number of classified projects which they cannot discuss fully in open session.

We have in the room here many exhibits which we will not take time to describe, and we hope that afterwards the members of the subcommittee will find time to take a look at them and get them described.

Now I would like to tell you some of the specific contributions of the Bulova Watch Co. I have been with the company ever since I left the Pentagon 11 years ago so I know something of their accomplishments and capabilities.

The contributions made by the Bulova Watch Co. to national defense during World War II and Korea were many. In World War II, Bulova converted 100 percent to war production. This was done with a minimum loss of time because of the skill of its workers. We made millions of fuses, precision parts for telescopes, torpedoes, and other items. I have attached a list of these items, and the quantities, to my written statement.

In more recent times we have developed and produced many types of fuses, safe-arming devices, and other items. Our work force remains no less vital for the Nation's defense than in former years.

As an example of this, I cite a highly sophisticated timing device we are making for the Sandia Corp., a prime contractor of the Atomic Energy Commission. It is our understanding that prior to approaching Bulova, Sandia had made a comprehensive survey of American industry to determine who had the skilled manpower, experience, facilities, and equipment to manufacture these timer units. From its survey, Sandia found that the piece parts and components required for the timer unit were available domestically only through the American watch industry, and thus turned to the watch industry as the only source for the production of the timers.

I would like for Mr. Van Haaften, who is in charge of our timer section, to show you very briefly what is involved in this timer for Sandia.

Mr. VAN HAAFTEN. This timer represents a family of precision millisecond timers being made in quantity by the Bulova Watch Co. for the Sandia Corp. Of particular interest is the escapement which is shown here, which is patterned after the watch escapement, but beats 12 times faster, and it must operate under a wide range of environmental conditions without an oil lubricant.

To achieve this result required a considerable advancement in the state of the horological art.

General BRADLEY. If we have time afterward, we hope you will take an even closer look at this.

The key of it is that it has an escapement here which most segments of industry cannot furnish.

Another illustration of how Bulova's watchmaking, engineering, and production abilities are considered vital to the never-ending efforts of defense agencies to develop more effective and reliable articles of war, concerns a recent program of the Department of the Army. It has a requirement for a single mechanical fuse that will function reliably and accurately for all tactical requirements of all military weapons systems in the caliber range of 75 millimeter and up. This fuse has been designated the "universal fuse." Some 750 companies indicated interest in a contract to design, develop, and produce such a fuse. Of these, 56 attended a technical briefing on the requirements for the fuse. Bulova was awarded the contract because the procuring agency found that a watch company had not only submitted the best technical solution to the problem for fair and reasonable cost, but possessed the required horological knowledge and depth of experience in developing and producing fuses.

Both of these items, along with most fuses and safe-arming devices contain some form of escapement. The watch companies have years of day-to-day experience in the manufacture of escapements. It is for this reason that defense agencies have often turned to the domestic watch industry when the item to be procured contains such a timing mechanism.

In fact, where devices incorporate an escapement or timing mechanism, it will be found more often than not that the escapement or timing units have been manufactured by companies in the horological industry. As an illustration of this, two nonwatch companies in addition to Bulova are now making a certain fuze, (M–524), but Bulova has supplied, for itself and as a subcontractor, more than 1,500,000 escapement units. This is recognition that timing mechanisms are within the current competency of Bulova to produce on short notice. It is this present capability that must be retained.

Within the past several years, Bulova has undertaken over 60 programs involving timing mechanisms. I have listed these programs in an attachment to our written statement. It is also significant to specifically note that Bulova has done much to assure the successful production of safe-arming and programer components for the Sparrow, Terrier, Tartar, Talos, Asroc, Corvus, Dart, Shillelagh, Sidewinder, Bullpup, Minuteman, Polaris, and Pershing missiles. In the further application of our capabilities to safe-arming devices, we are pressing forward for new concepts based on proven mechanisms by taking the X–100 series of safe-arming mechanisms for the Sidewinder, Dart, and Shillelagh missiles (of which we produced over

2 million), and making it a module for a complete and revolutionary development in safe-arming devices.

Our latest advance in timekeeping is our Accutron. This development is a revolutionary concept in personal timekeeping. In place of the balance wheel, and hairspring of a conventional watch, Accutron uses a tuning fork as the time standard. The tuning fork is electronomagnetically driven with energy from an electrochemical cell or battery, by means of a transistorized electronic circuit. Vibratory motion of the tuning fork is connected into a rotary motion for turning the hands by a rachet and pawl system. By this new type construction, accuracy in timekeeping has been so increased that Bulova guarantees the Accutron will not gain or lose more than 2 seconds per day.

Accutron, and Hamilton's electric watch, are the only major horological advancements that have been made in personal timekeeping within the past century. The development of these watches is an American achievement, which would not have been possible without the research, engineering, and production skills of personnel in the watch industry.

Although Bulova has produced Accutron primarily for use by the general public, there have been many applications of Accutron for national defense and national interest programs. Its chief attributes for such programs are its extreme accuracy, small size, and low power consumption. Accutron timers have been successfully used in the Explorer, Telstar, Tiros, and Syncom satellites to provide a self-contained means of turning off their radio transmissions after long but preset periods of time. Until Accutron was used for such purposes, there was a problem of how to shut off transmissions from satellites that had radioed back the data for which they had been programed to obtain. Of course, such transmissions could be terminated by a radio signal transmitted to the satellite. This method is not ideal for several reasons. The first is that additional complex equipment, about 30 pounds in some cases, is required to effect this switching.

I might interpolate here the timer made out of the Accutron weighs 8 ounces.

In some instances the use of radio switching means assigning a frequency on a standby basis for a long period of time. In addition, a malfunction could damage the receiver so that the radio switchoff signal would not be received. This is why the small Accutron clock is so ideally suited for this application.

I would like to quote from a letter we received from Mr. James E. Webb, Administrator of NASA. The complete letter is included in my written statement. And I quote:

> I note on my "satellite calendar" that the third anniversary of the Explorer XI "switchover" of experiments is coming up on May 26. This event, as I recall, was the first successful operation of an accurate, self-contained time-delay switching function within an orbiting satellite.
>
> This is an excellent example of the strong support provided by American industry in the space program, for it was the electronic timer developed and manufactured by your company that made this possible. It is also an outstanding example of technological innovation useful in space, which has parallel value for consumer use here on earth, as well, in the form of the timepiece which you call Accutron.

We have on the board over here on this side several models made up of timers in which are used the Accutron. I hope you have a chance to look at them later.

Accutron is also being used in other programs of the Government; as clocks for cameras on Air Force programs, oceanographic studies and investigations by Scripps Oceanographic Institute, applications for NASA, the Countermeasures Research Laboratory, the Coast and Geodetic Survey, U.S. Weather Bureau, Naval Avionics, and many more. And these applications are only a beginning to the many possible applications of Accutron to both national defense and national interest projects.

In recent times we have heard much about the "fallout" of technological benefits to the American public from Government-sponsored research and development. Here we have the reverse of this. Bulova, with its own resources, has developed and produced Accutron. From such development, the Federal Government is now receiving a significant "fallout" benefit by being able to successfully utilize a device for which not $1 of taxpayers' money has been required. While I have stated this before, I want to again say that this utilization would never have been obtained by the Government without the engineering, technical, and manufacturing know-how of Bulova's watch manufacturing organization.

Another contribution we have made is in the production of jewel bearings. Bulova was a leader in this field during World War II, and since 1953 has operated for the Government, at Rolla, N. Dak., the only factory in the United States producing jewel bearings on a volume basis. A more complete discussion of this activity is included in my written statement.

It would be altogether possible for Bulova to rely almost entirely upon the importation of watch movements and watches from foreign sources and yet maintain its competitive position in the marketing and sale of watches. If we had to do this, there would be no need to hold on to our present staff of engineering and production personnel. Disbanding this staff is what must follow whenever, for example, reductions in the present rates of duty would dictate that reliance upon imports would be for the best interests of our stockholders. If this occurs, all further research and development in the United States for new watch products and horological improvements will come to an end at Bulova. The tremendous strides in the horological arts Bulova has made within the past 5 years will be forever cut off, for once a work force with such training and experience is disbanded, it cannot be readily reestablished.

I have been able to touch on only a few of Bulova's contributions to national defense. But the manufacture of watches in the United States may shortly become only a memory. To maintain the skills of watch manufacturing in a state of effective readiness for defense work requires such skills to be applied to the day-to-day problems of watch manufacture.

However, imports of jeweled watches and watch movements into the United States are now at a level where they account for 86 percent of the domestic market. This "handwriting on the wall" clearly indicates that, in the absence of effective governmental action, survival of the remaining companies of the domestic watch industry must depend more and more upon their importing watch movements and complete watches to remain competitive. The trend to import more and produce less in this country is well underway. To demonstrate how the trend to increased imports with curtailment of domestic manufacture is affecting Bulova, an analysis of the present force of skilled watch production workers reveals the following disturbing facts: We reported in 1954 to the Senate committee making a similar investigation as now, the number of people employed by Bulova in certain essential skills of watch production for 1948, 1950, and 1953. This listing is attached to this statement with a fourth column showing the substantially reduced level of skilled people presently employed in the same categories.

In view of the manifest ways in which the watch industry is contributing to the national defense, it is impossible for me to understand how any thoughtful citizen of the United States can seriously consider permitting this industry to be forfeited for the sake of commercial interests of the Swiss.

Are we going to allow ourselves to become the only major power in the world without a watch manufacturing industry? I hope not. I hope our Government will find some solution that will maintain at least the small remaining capability we still possess.

(The prepared statement referred to follows:)

PREPARED STATEMENT OF GEN. OMAR BRADLEY, CHAIRMAN, BULOVA WATCH CO.

Today, this subcommittee is considering a subject, "National Defense," that has been dear to my heart for 53 years—that being the number of years I have been in the service of my country—and I welcome this opportunity to present some facts which are also important to you—members of the Senate Armed Services Committee.

The Bulova Watch Co. is a publicly owned company, listed on the New York Stock Exchange, with some 5,500 stockholders. We are the largest importer of jeweled-lever watches, a substantial number of which are produced in our own plant in Switzerland. We are the largest single manufacturer of jeweled-lever watches in Switzerland, and we are the largest producer of jeweled watches in the United States.

As far as profits for our stockholders are concerned, we might even earn more if we were 100-percent importers, but at the price of becoming wholly dependent on foreign sources. We are already importers of a major part of our watches. On the other hand, to discontinue the manufacture of watch movements in this country would eliminate our company's need for the integrated engineering, research, and production work force and facilities we now maintain as a watch manufacturer.

We are of the conviction that it is extremely vital to our country's security that this remaining nucleus of watchmaking engineering, technicians, and production specialties should not be eliminated from our Nation's armory.

Right now, approximately 85 percent of the jewel-lever watches sold in the United States are imported, and this percentage has been increasing steadily for the last decade. In 1954, there were some 4,300 people engaged in making jewel-lever watches. Now, there are about 2,500.

I understand that the question before your committee today is how much does the domestic watch industry contribute to our armed strength—or whether this industry is important to national defense.

This subject is a vital one right now, because the Tariff Commission is considering whether the present tariff structure on imported watches should be reduced. The domestic producers of watches feel that a reduction of tariffs would speed the death of our domestic industry, and our companies would then become 100-percent importers.

The Swiss watch industry, and the importers that are not also producers, will probably tell you that a reduction of tariffs will not hurt the domestic producers. We strongly believe it will, and we should be in a much better position to know than the nonmanufactuers. Since Bulova is the only company with manufacturing plants in both Switzerland and the United States, we can tell first hand how serious a duty reduction would be. We are the ones who best know our wage and cost structures, and the difficulties of trying to overcome the comparative cost disadvantage of manufacturing watch movements in this country even at present duty levels.

Actually, of course, the question of tariffs is not the one before your committee, but it shows that your interest in a discussion of the importance of the domestic watch industry is very timely.

Let's examine the past records on this subject.

In 1954, a subcommittee of the Senate Armed Services Committee found that the domestic watch industry was essential to national defense.

In that same year, a similar finding was made by the Office of Defense Mobilization. This finding was concurred in by the Secretary of Defense when he stated in 1955 that, and I quote:

"In the course of the study it became apparent that the entire horological industry (the nonjeweled watch and clock producers as well as the jeweled watch manufacturers) was essential to the mobilization base * * * The Department of Defense does not expect jeweled watches to be the jeweled watch industry's only basis of essentiality. It expects the jeweled watch industry, together with the balance of the horological industry and other capable manufacturers, to the degree that they are able, to continue to design and produce very complex timing mechanisms, control devices, gyroscopes, and similar items which must be miniaturized and ruggedized if they are to be used in modern military equipment."

This same attitude was indicated by several foreign governments. England and France stated that they had been severely handicapped during World War II because of a lack of horological skills. England's views were aptly expressed by Sir Stafford Cripps, who was then serving as president of the board of trade, when he used the following language in explaining the military necessities that had led the British Government to launch a program on watch production:

"When the war came and we needed, naturally, to mobilize all the engineering resources we could muster, the inadequacies of the clock and watch industry left a very serious gap in what may be termed our industrial armory. If we had had a considerable watch and clock industry earlier, not only should we have avoided the risks which are inseparable in such circumstances from dependence on oversea sources, but we should have had a reservoir from which we should have drawn machine tools, skilled labor, and management well suited to the manufacture of many of those precision instruments upon which war so much depends today."

The sequence in France has been substantially the same as in Great Britain. Both countries have tried to develop and protect their watch industries.

Russia has greatly increased its watch production since World War II. If they did not consider this industry important to their national defense, why did they place their newest plants back in the Ural Mountains along with a lot of their other essential war industries? Now there are indications that China is starting to develop a watchmaking capability.

To quote further from the record, the Office of Defense Mobilization found in 1958, that the domestic jeweled watch industry was not sufficiently essential to national defense to qualify under the law for import quota relief. Let's take a look at their reasoning in 1958.

In the first place, the Secretary of Defense would not go so far as to advise ODM that the watch industry was essential, but he did say, and I want to quote:

"Despite the downward trend of our reliance upon the jeweled watch industry, the Department of Defense must say that it is a very desirable industry with a commendable record of assistance in meeting defense needs, both in peacetime and under mobilization."

Moreover, as its name implies, the ODM was concerned primarily in what happens during mobilization, after an emergency occurs. But, aren't we more concerned in improvement of weapons now, so that our strength and state of preparedness discourages and prevents any such emergency?

Now let's take a look at the contributions of our watch industry to national defense. In World War II, Bulova and other watch producers converted 100 percent to war production. This was done with minimum loss of time because of their watchmaking skills.

The importance of the skills of which I speak is not a fiction. The defense agencies of this Nation know well the many contributions made by Bulova and the other domestic watch companies to the national defense during World War

II and the Korean conflict. Thousands upon thousands of fuses, parts for telescopes, torpedoes, and other essential war materiel were produced by Bulova. At this time I shall not describe in detail all these articles, but a listing of them is submitted for the record with this statement.

Turning to the present, our work force remains no less vital for the Nation's defense than in former years. As an example of this, I cite a defense program in which we have made and are continuing to make, a major contribution.

Several years ago the Sandia Corp., a prime contractor of the Atomic Energy Commission, came to Bulova for the production of a very sophisticated timing device. It is our understanding that prior to approaching Bulova, Sandia had made a comprehensive survey of American industry to determine who had the skilled manpower, experience, facilities, and equipment to manufacture these timer units. Included in this survey were, of course, organizations of many different types of industries. The timing devices required by Sandia for a classified application, incorporate detached-lever escapements based upon extremely close tolerances and ultraprecision workmanship. From its survey, Sandia found that the piece parts and components required for the timer unit were available domestically only through the American watch industry. Sandia Corp. thus turned to the watch industry as the only source for the production of these particular timers. I am very pleased to state that we have to date successfully manufactured and delivered over 4,800 of these highly complex time units for Sandia Corp.

Another illustration of how Bulova's watchmaking, engineering, and production abilities are so vital to the never-ending efforts to defense agencies to develop more effective and reliable articles of war, concerns a recent program of the Department of the Army. It has a requirement for a single mechanical fuse that will function reliably and accurately for all tactical requirements of all military weapon systems in the caliber range of 75 millimeters and up. This fuse has been designated the "universal fuse." Some 750 companies indicated interest in a contract to design, develop, and produce such a fuse. Of these, 56 attended a technical briefing on the requirements for the fuse, and of these only 9 submitted proposals to undertake the contract. Included in these nine companies were Bulova, Hamilton, and Elgin, the only remaining manufacturers of jeweled-lever watch movements in the United States. Bulova was awarded the contract because the procuring agency found Bulova had not only submitted the best technical solution to the problem for fair and reasonable cost, but possessed the required horological knowledge and depth of experience in developing and producing fuses.

The two examples I have just referred to have one very important thing in common, along with most fuses and safe-arming devices—they contain some form of "escapement," a controlling mechanism to assure that the programed functioning of the unit will take place as planned. It is the escapement that is the "heart" of these articles, for it must function accurately and reliably or the entire unit fails to accomplish its purpose. Bulova, Elgin, and Hamilton have years of day-to-day experience in the manufacture of escapements. It is for this reason that defense agencies or prime contractors have usually turned to the domestic watch industry when the item to be procured contains such a timing mechanism.

Bulova does not, of course, claim that it is the only organization that can manufacture all the fuses, all the mechanical accelerometers and safe-arming devices required by our defense agencies. However, where such devices incorporate an escapement or timing mechanism, it will usually be found that the escapement or timing units have been manufacturd by companies in the horological industry. As an illustration of this, in a very recent procurement, Bulova supplied, as a subcontractor, to 4 nonwatch industry prime contractors, more than 1,500,000 escapement units.

It has often been the charge that companies of other industries can also produce the same mechanisms as does the domestic watch industry. I doubt whether there is anything being manufactured by any one company in the world that, given enough time and unlimited funds, some other company in a wholly unrelated industry cannot duplicate. Perhaps the four prime contractors to whom we supplied the escapements, noted above, could, with enough time and money, also produce escapements. Yet, what the domestic watch producers have is an existing capability which stands ever ready and available for immediate application to such defense requirements. It is this present capability that must be retained, for once it is lost this Nation will not in the event of an emergency be able to reestablish it.

Bulova is currently applying its watchmaking, engineering and production experience to programs of research, development, and production for defense agencies. Within the past several years, Bulova has participated in 60 or more programs in which it has supplied key components and equipment for many of this Nation's missiles, such as Pershing, Terrier, Talos, Sidewinder, Sparrow, Tartar, Asroc, Corvus, Dart, Shillelagh, Bullpup, Minuteman, and Polaris. These items have ranged from miniature, rugged timers to complete fusing and arming systems. A listing of these programs is set forth in an attachment to this statement.

In the further application of our capabilities to safe-arming devices, we are pressing forward on new concepts based on proven mechanisms by taking the X–100 series of safe-arming mechanisms for the Sidewinder, Dart, and Shillelagh missiles (of which we produced over 2 million), and making it a module for a complete and revolutionary development in safe-arming devices.

At the beginning of this statement, I said that it would be entirely feasible commercially for Bulova to rely almost entirely upon the importation of watch movements and watches from foreign sources and yet maintain its competitive position in the marketing and sale of watches. I said that if we had to do this, there would be no need to retain our present staff of engineering and production personnel. Disbanding this staff will necessarily result if, for example, a substantial reduction in the present rates of duty should dictate that reliance upon imports would be for the best interests of our stockholders. If this occurs, all further research and development in the United States for new watch products and horological improvements will come to an end at Bulova. The tremendous strides in the horological arts Bulova has made within the past 5 years will be forever cut off, for once a work force having such training and experience is broken up, it cannot be readily reestablished.

I have on my wrist an Accutron timepiece. This development is a revolutionary concept in personal timekeeping. In place of the balance wheel and hairspring of a conventional watch, Accutron uses a tuning fork as the time standard. The tuning fork is electronomagnetically driven with energy from an electrochemical cell or battery, by means of a transistorized electronic circuit. Vibratory motion of the tuning fork is connected into a rotary motion for turning the hands by a ratchet and pawl system. By this revolutionary type construction, accuracy in timekeeping has been so increased Bulova guarantees the Accutron will not gain or lose more than 2 seconds per day.

Accutron, and Hamilton's electric watch, are the only major horological advancements that have been made in personal timekeeping within the past century. The development of these watches is an American achievement, which would not have been possible without the research, engineering, and production skills of personnel in the watch industry. For each part and component of Accutron, our watchmaking capabilities have pushed the state of the art far beyond previously recognized limits. Take, for example, the tiny index wheel of Accutron. On this wheel are 300 precisely machined teeth. Another example is the wire that is used on the two small coils of Accutron. This wire is so fine that its diameter is approximately one-fifth the size of a human hair. In every part, the problems and difficulties encountered to make Accutron a reality were solved by the ingenuity and knowledge of our engineers and production personnel, and this entire development was accomplished solely with the financial resources of Bulova.

Although Bulova has produced Accutron primarily for use by the general public and entirely with its own funds, there have been a number of applications of Accutron for national defense and national interest programs. Its chief attributes for such programs are its extreme accuracy, small size, and low power consumption. Accutron timers have been successfully used in the Explorer, Telstar, Tiros, and Syncom satellites to provide a self-contained means of turning off their radio transmissions after long but preset periods of time. Until Accutron was used for such purposes, there was a problem of how to shut off transmissions from satellites that had radioed back the data for which they had been orbited to obtain. Of course, such transmissions could be terminated by a radio signal transmitted to the satellite. This method is not ideal for several reasons. The first is that additional complex equipment, about 30 pounds in some cases, is required to affect this switching. In some instances this means assigning a frequency on a standby basis for a long period of time. In addition, a malfunction could damage the receiver so that the radio switch-off signal would not be received. This is why the small, relatively weightless Accutron clock is so ideally suited for this application.

Accutron is also being used in other programs of the Government: as clocks for cameras on Air Force programs, oceanographic studies, and investigations by Scripps Oceanographic Institute, applications for NASA, the Countermeasures Research Laboratory, the Coast and Geodetic Survey, U.S. Weather Bureau, naval avionics, and many more. And these applications are only a beginning to the many possible applications of Accutron to both national defense and national interest projects.

In recent times we have heard must about the "fallout" of technological benefits to the American public from Government-sponsored research and development. Here we have the reverse of this. Bulova, with its own resources, has developed and produced "Accutron." From such development, the Federal Government is now receiving a significant "fallout" benefit by being able to successfully utilize a device for which not $1 of taxpayers' money has been required. I want to again say that this utilization would never have been obtained by the Government without the engineering, technical, and manufacturing know-how of the functioning watch manufacturing organization which Bulova has in this country.

Bulova's contributions to national defense do not begin and end with its production and supply of the equipment and devices I have spoken about. For the past 10 years, Bulova has provided services at the Government-owned Turtle Mountain Ordnance Plant, Rolla, N. Dak., for the production of instrument jewel bearings. These services have been furnished by Bulova in return for reimbursement of its costs. The jewel bearings manufactured at this plant are for the Government's strategic and critical materials stockpile and for defense contractors and subcontractors whose contracts require end items containing jewel bearings.

For those who are not completely familiar with why it is that our country has such a facility and how Bulova came to operate it, a brief review of the jewel-bearing situation in two recent armed conflicts may be appropriate. Normally, all jewel bearings for watches and instruments are imported. Just prior to our involvement in World War II, Mr. Arde Bulova, then chairman of the board of our company, urged our Government to establish a production facility for jewel bearings so that we would not be dependent upon foreign sources in time of a national emergency. This recommendation was based upon a realization that if Europe was overrun by Hitler, the only major source for jewel bearings, Switzerland, would be sealed off and prevented from supplying our requirements. Without jewel bearings, many vital and necessary articles of war cannot be manufactured.

Unfortunately, our Government did not immediately act upon Mr. Bulova's recommendation to make provision for an instrument jewel-bearing manufacturing facility. Nevertheless, Mr. Bulova proceeded on his own to bring out of Switzerland a number of people who knew how to make jewel-bearing machinery. Upon their arrival in the United States, they commenced construction of such machinery.

As feared, when the United States entered World War II, there was no complete and self-sufficient facility in this country for jewel bearing production. With the fall of French, èxports of jewel bearings from Switzerland to the United States were stopped by the Axis Powers. With U.S. Government funds, however, a number of complete sets of jewel bearing machinery were made and distributed to companies throughout the country. Some 27 companies eventually became engaged in the manufacture of the bearings. Even with this broad manufacturing base, not enough instrument bearings were produced to supply our needs. We remained dependent upon whatever small quantities of jewel bearings could be smuggled out of Switzerland as a supplement to our production.

As a matter of fact there was, as I understand it, a time when even the Swiss could not manufacture jewel bearings, and that an "accommodation" was arranged between the British and Germans to permit the continuation of Swiss production. To make jewel bearings requires diamond powder as an abrasive. In World War II, the British controlled the only source for the type of diamond powder needed. This source was in South Africa. Without this powder, the Swiss could not make jewel bearings for the German war machine. Confronted with this situation, an agreement was worked out whereby the British released the diamond powder to the Swiss and the Germans permitted the Swiss to ship certain quantities of jewel bearings to the British and its allies. I do not know what we would have done without this additional supply source for instrument bearings. Only a few in our Government appreciate how very close we came to not being able to turn out essential war materiel because we did not have jewel bearings.

After World War II, the jewel bearing machinery that had been made in this country was put in storage. With the outbreak of the Korean conflict, we somehow or other "discovered" that jewel bearings were still a requirement for an almost endless list of precision instruments for defense, and that we were still dependent upon foreign sources for their supply. It was then determined by the Government to establish a permanent jewel bearing capability in this country.

This decision was based, in part, upon two very hard lessons we had learned from our experience with jewel bearings in World War II. First, it is imperative that this country should have its own independent facility to produce instrument bearings for defense purposes; and, second, you simply cannot start from scratch and expect to be able to produce jewel bearings in a period of 1, or 2, or even 3 years. It takes much longer than this. We found how difficult it is to manufacture these small items from scratch. Had it not been for the additional quantities of jewel bearings we managed to get out of Switzerland, we would have been in quite a spot in World War II. To avoid getting into this kind of situation again, there must be a buildup of skills over a very long period of time to the point where at least the minimum defense requirements for instrument bearings can be satisfied from domestic sources. Then, the skilled work force that has been developed must be maintained. I might say that acquiring knowledge and skills in the manufacture of jewel bearings is very much like the problem of developing and maintaining key skills in the watchmaking industry. Years and years of training and experience must form the base from which successful manufacture can result.

In the early 1950's, therefore, our Government located the stored jewel-bearing machinery and equipment; the Turtle Mountain Ordnance Plant at Rolla, N. Dak., was activated, and Bulova has furnished services for its management every since. As a part of its continuing interest in contributing to the national defense, Bulova has been glad of the opportunity to apply its watchmaking knowledge, experience, and know-how to the production activities of this jewel-bearing plant.

Today, our operation of this plant is about to lead to a standardization of jewel bearings, which will be of great assistance to instrument manufacturers.

I sincerely trust that I have, in this summary statement, been able to show Bulova's major contributions to the national defense in programs of research, development, and production, and the importance of its capabilities to the Nation's industrial base in time of emergency. These contributions are of an American company in an industry, the jewel-lever watchmaking industry, which has less than 14 percent of the domestic market for its watch products. Mindful that labor comprises 85 percent of the cost of a watch, and with the great disparity between labor costs in the United States and those in Switzerland and Japan, the inadequacy of the present rates of duty on watch imports is such that, without some form of relief, the manufacture of watches in the United States may shortly become only a memory.

To maintain the skills of watch manufacturing in a state of effective readiness for defense work requires these skills to be applied to the day-to-day problems of watch manufacture. However, imports of jeweled-lever watches and watch movements into the United States are now at a level where they account for over 85 percent of the domestic market. This "handwriting on the wall" clearly indicates that, in the absence of effective governmental action, survival of the remaining companies in the domestic watch industry must depend more and more upon importing watch movements and complete watches to remain competitive. The trend to import more and manufacture less in this country is well underway.

To demonstrate how the trend to increased imports with curtailment of domestic manufacture is affecting Bulova, an analysis of the present force of essential skills for watch production reveals the following disturbing facts: We reported in 1954 to the Senate committee, making a similar investigation as now, the number of people employed by Bulova in certain essential skills of watch production for 1948, 1950, and 1953. This listing is attached to this statement with a fourth column showing the substantially reduced level of skilled people presently employed for 1964 in the same categories.

It is quite obvious that such employment reductions do not reflect a healthy condition. We are now down to the minimum number in each job category to manufacture watch movements scheduled for our U.S. plant. Further reductions in domestic watch manufacture we may have to make to compete in the marketplace will most assuredly require further reductions in our engineering, technical, and manufacturing work force.

It is one of the most perplexing things I have ever encountered to realize that the very existence of an industry so vital to this Nation's defense is now at stake, while other world powers have recognized the same industry to be extremely essential to their national interests. The Soviet Union, Great Britain, and France—to say nothing of Switzerland—have all taken active measures to develop and expand their watch industries. Such means have included tariffs, subsidies, and quotas, but the fact remains that by their actions these countries have successfully maintained vigorous and effective watchmaking capabilities.

At this very moment the entire world is a tinderbox of war—the Congo, Cuba, Cyprus, Vietnam, all attest to this. The United States is being forced to apply its military resources throughout the world. Whether by conventional or nuclear weapons, we must continue to respond to every threat to peace.

In view of the manifest ways in which the U.S. jeweled-lever watch industry has and is contributing to the national defense, in view of the efforts by Russia, Great Britain, and France to nurture their own watch industries, and in view of the critical world situation, it is virtually impossible for me to understand how any thoughtful citizen of the United States can seriously consider permitting our domestic watch industry to be forfeited for the sake of the commercial interests of the Swiss.

Yet, here we have the Swiss, as in the past, injecting themselves into a strictly American affair, and you may be sure they will urge that our defense agencies do not need the capabilities of the domestic watch industry. For commercial reasons only, the Swiss want Bulova, Elgin, and Hamilton to become importers, rather than remain manufacturers in this country as a continuing threat to their own watchmaking ambitions. But this is not for the purpose of acquiring for themselves the remaining 15 percent of the domestic market for watches. What they are really after is the complete elimination from the United States of the research and engineering capabilities now represented in the domestic industry, which were responsible for developing and producing the only major horological innovations of this century—Bulova's "Accutron" and Hamilton's electric watch. It is these very same skills and experience that have made possible our contributions to national defense.

Are we going to allow ourselves to become the only major power in the world without a watch-manufacturing industry? I hope not. I hope our Government will find some solution that will maintain at least the small remaining capability we still possess.

Exhibit A

Bulova Defense Work—World War II

For Army Air Corps:
- 35,000 rate-of-climb indicators.
- 35,000 altimeters.
- 216,336 navigation hack watches.
- 50,000 8-day aviation clocks.
- 7,692 ammeters.
- 2,000 gasoline injection pumps.
- $75,000 value, watch spare parts.

For Army Ordnance:
- 3,324,730 T–105 concrete piercing fuses.
- 3,765,300 T–49 time fuses.
- 3,000,000 T–48 time fuses.
- 5,000,000 M–103 A 1 gears for fuses.
- 200 T–148 time fuses.
- 505,000 W–88 B.D. fuses.
- 350,000 M–120 bomb nose fuses.
- 220,000 M–4A2 rocket fuses.
- 1,250,000 M–22 boosters.
- 1,994,050 M–66 A 1 B.D. fuses.
- 150,000 M–72 B.D. fuses.
- 221,054 watches.
- 416 M–72D telescopes.
- 6,299 M–71D telescopes.

For Army Ordnance—Continued
- 300 M–71S telescopes.
- 1,317 M–71C telescopes.
- 175 T–116 telescopes.
- 15 M–3A 1 repair fixtures for panoramic telescopes.
- 263 M–1918.
- 18,331 M–70 telescopes.
- 50 M–61 fixtures, elbow telescopes.
- 50 M–5 fixtures, elbow telescopes.
- 27 M–70Q telescopes.
- 1,012 M–70G telescopes.
- 1,012 M–70H telescopes.
- 1,400 M–6A1 elbow telescopes.
- 1,450 M–71D telescopes.
- 5,865 M–55 telescopes.
- 2,150,000 firing pins.
- 9,000,000 pinions.
- 2,590,000 firing shafts.
- 2,847,000 escape wheels.
- 3,000,000 arbors.
- 1,100,000 adjusting screws.
- 1,700,000 hammers.
- 3,967,000 center weights and shafts.
- $150,000 value, watch spare parts.

For U.S. Army Signal Corps:
- 60 conoscopes.
- 1,000 ammeters.

For Defense Supplies Corporation: 3,000,000 jewel bearings for precision instruments.

For Defense Plant Corporation: $700,000 value, machinery for making jewel bearings.

For Newport Torpedo Station:
- Castings for torpedoes.
- Bronze pieces for torpedoes.
- Stock parts for torpedoes.

For Ford Motor Co.: Precision parts for aviation instruments.

For Sperry Gyroscope Co.: Precision roller bearings for automatic rangefinder.

Total value of war items manufactured, approximately $48 million.

Defense Programs Involving Timing Mechanisms Undertaken by Bulova in Past Several Years

Army:
- T–1410 fuze and noze switch for Dart missile, Picatinny Arsenal.
- XM integrating accelerometer test, Picatinny Arsenal.
- High explosive, armor piercing—study, Picatinny Arsenal.
- Electric fuzes—Artillery (chemical), Picatinny Arsenal.
- Shillelagh safety and arming and fuze, Picatinny Arsenal.
- 70- to 90-millimeter PDSD fuzes, Picatinny Arsenal.
- Air burst bomb fuze, Picatinny Arsenal.
- Photoflash bomb fuze, Picatinny Arsenal.
- Electric time fuzes, Frankford Arsenal.
- BD fuze for large caliber HEP, Picatinny Arsenal.
- 70 millimeter to 2.75 inch BDSD rocket fuzes, Picatinny Arsenal.
- PD fuze for rocket, Picatinny Arsenal.
- 1.5 inch BDSD air-to-rocket fuze, Picatinny Arsenal.
- 37 millimeter BDSD fuze (AA), Picatinny Arsenal.
- PDSD fuze for USAF 30 millimeter (phase I), Picatinny Arsenal.
- BD fuze for HEP rounds, Picatinny Arsenal.
- Hand grenade fuze, Picatinny Arsenal.
- 30 millimeter BDSD air-to-air fuze, Frankford Arsenal.
- 30K Dart gyro, Aerophysics Division Corp.
- Pershing AK fuze and arming system, Martin Co.
- M 524—E2 fuze, Picatinny Arsenal.

Navy:
- T–3002 Sparrow safety and arming, NBS, DOFL, NOL/Corona.
- T–3002 Sparrow safety and arming production, DOFL, Bendix, Frankforu Arsenal.
- T–3001 Terrier safety and arming, DOFL, NOL/Corona.
- T–3001 Terrier safety and arming, production, BuOrd.
- T–3000 Talos safety and arming (MK4, model O and 1 S–A) (MK 12–S–A), NOL/Corona.
- Ex–7 advanced Terrier and Talos, safety and arming, NOL/Corona.
- T–3000 Talos safety and arming, production, BuOrd.
- MK–304 Sidewinder contact fuze, NOTS, NOL/Corona.
- MK–304 Sidewinder contact fuze, BuOrd.
- MK–11 Sidewinder safety and arming, NOL/Corona.
- Ex–19 Corvus safety and arming, Temco Aircraft.
- AT–1 safety and arming switch (WOX 1A and 1B), NOL/White Oak.
- Hermetic seal mine timer, NOL (BuOrd).
- Mechanical time fuzes 5 inches and larger, NOL (BuOrd).
- Bolometer production study, BuOrd.
- Separation timer, thrown torpedo, BuOrd.
- Rocket flare-delay fuze, NOTS/(NPO/LA).
- Terrier safety and arming make 6 model O, rocket flare fuze, NOTS/(NPO/LA).
- Tartar safety and arming make 7 model O, Polaris igniter, Aerojet General Corp./BuWeps.
- Bullpup fuze make 312 model O, BuWeps.

Air Force:
- Safety device for air-to-surface missiles, AFSWC.
- Minuteman first stage igniter, safety and arming, Thiokol.
- Minuteman second stage igniter, safety and arming, Aerojet.
- Minuteman third stage igniter, safety and arming, Hercules Powder Co.
- Minuteman standardized igniter, Thiokol, Hercules, Aerojet.
- Minuteman first stage destructor, safety and arming, Thiokol.
- Minuteman third stage destructor, safety and arming, Hercules Powder Co.
- Minuteman third stage thrust terminator, Hercules Powder Co.
- Electrical fuze, Martin Co.
- Rotating fuze, Picatinny Arsenal.
- Missile igniter, Thiokol Igniter Corp.
- Safety and arming device, BuWeps.
- In-flight-safety switch, Bendix Aviation.
- Piezo-electric accelerometer, Bendix Aviation.
- Accelerometer, BuWeps.
- Accelerometer, Minneapolis-Honeywell.

Exhibit B

Bulova Watch Co.

The domestic horological industry—Skills and training

CATEGORY A.—HOROLOGICAL SKILLS REQUIRING 10 YEARS' EXPERIENCE OR MORE

Title	Requirements	Employed on watch manufacture 1948	1950	1953	1964
I. Technical supervision:					
Manufacturing engineer, chief	Degree or equivalent and 10 to 12 years experience.	3	3	1	1
Product design engineer, chief	Degree or equivalent and 10 years experience.	4	4	1	1
Research and development director	Degree or equivalent and 12 years experience.	1	1	0	1
Metallurgist, chief	Degree or equivalent and 10 years experience.	1	1	1	1
Chemist, chief	do	2	2	1	0
Physicist, chief	do	1	1	0	0
Crystallographer, chief	do	1	1	0	0
II. Labor:					
Model maker	10 years experience	6	6	2	2
Tool and die maker, chief	10 years plus experience	16	12	7	13
Tool and die maker, class I	10 years experience	45	35	15	46
Diamond wire drawing diemaker	do	2	2	2	1
Steel engraver (tools)	do	1	1	1	1
Profile grinder technician, tools and dies.	do	3	3	2	2
Swiss jig boring and grinding machine technician.	do	3	3	1	2
Total		89	75	34	71

CATEGORY B.—HOROLOGICAL SKILLS REQUIRING 6 TO 10 YEARS' EXPERIENCE

Title	Requirements	1948	1950	1953	1964
I. Technical supervision:					
Tool engineer	Degree or equivalent and 8 to 10 years' experience.	4	3	1	1
Methods engineer, chief	do	4	3	2	1
II. Labor:					
Tool and die maker, class II	8 to 10 years' experience	25	15	10	3
Tool and die maker, class III	6 to 8 years' experience	20	17	10	3
Toolmaker, diamonds	8 years' experience	5	4	3	2
Pinion master form and cutter maker 0.0001" on sizes and shape.	6 years' experience	4	4	2	2
Electronic technician	do	2	1	1	1
Total		64	47	29	13

The domestic horological industry—Skills and training—Continued

CATEGORY C.—HOROLOGICAL SKILLS REQUIRING 3 TO 5 YEARS' EXPERIENCE

Title	Requirements	Employed on watch manufacture			
		1948	1950	1953	1964
I. Technical supervision: Quality control director.	Degree or equivalent and 3 to 5 years' experience.	1	1	1	1
II. Labor:					
Watchmaker, class I	Makes parts, 5 years' experience	3	2	2	5
Watchmaker, class II	Old watches, 4 years' experience	35	29	28	15
Watchmaker, class III	Current watches, 3 years' experience.	12	11	10	5
Watch adjuster, class I	Whole movement, 4 to 5 years' experience.	17	13	11	10
Watch adjuster, class II	Balance and hairspring, 3 years' experience.	9	6	6	5
Precision miller setup	Mikron, Peterman, Bechler, 3 plus years experience.	25	25	20	10
Multiple-spindle driller setup	S. & V., Kingsburry, Gilman, 2 to 4 years' experience.	9	8	4	2
Automatic lathe setup	Tornos, Bechler, Gibbs, etc., 4 years' experience.	6	3	3	2
Spring manufacturing setup	Melting, rolling, diamond die drawing, 3 years' experience.	2	2	1	2
Tool and die maker, class IV	4 to 6 years' experience	5	2	1	1
Toolmaker, carbide	4 years' experience	17	15	10	6
Thread grinder (precision)	4 to 6 years' experience	1	1	1	0
Coordinate measuring machine technician.	Dixi, Hauser, 3 to 6 years' experience.	6	6	3	2
Tap and die maker technician	4 years' experience	4	4	2	2
Chronometer adjuster	5 years' experience	1	1	1	0
Total		153	129	104	68

CATEGORY D.—HOROLOGICAL SKILLS REQUIRING 1 TO 2 YEARS' EXPERIENCE

II. Labor:					
Watch adjuster, class III	2-plus years' experience	9	6	6	5
Watch assembler	Finishers, 2-plus years' experience	175	145	135	105
Hairspring assembler	Truing, overcoiling, 2-plus years' experience.	75	59	59	45
Assembly inspector	Utility, final movement 2-plus years' experience.	25	25	20	15
Profile and flat turning setup	Mikron, Hauser, Billeter, 2- to 3-years' experience.	10	10	7	2
Automatic lathe operator	Operates above, 2 years' experience	45	44	40	20
Single-purpose bench machines setup.	2 years' experience	35	35	30	30
Chronometer assembler	do	2	2	2	0
Chronometer balance and hairspring assembler.	do	15	13	10	0
Total		391	339	309	222
Grand total		697	590	476	374

Senator SYMINGTON. Thank you, General Bradley. That is an interesting and thoughful statement. Senator Thurmond, have you any questions?

Senator THURMOND. Thank you, Mr. Chairman.

General Bradley was my commander when we went into Normandy on D–Day, so I feel very much at home around him.

General, I just want to say you have made a very thought-provoking statement here. I wish the American people all over this country could hear this statement.

It seems to me that we have permitted watches to be imported here to such an extent that we have practically destroyed our own industry in this country. I am very much concerned—and it is not in only the watch industry, but it is in other industries as well. I think that our

Government has got to take cognizance of what is happening, or we are going to lose the capability in many lines.

The watch industry, as you pointed out here, the part it plays in missiles, and various other items of defense, it is essential in my judgment that we maintain that capability. I am very glad to hear your statement.

I have no particular questions. Thank you Mr. Chairman.

Senator SYMINGTON. Senator Smith?

Senator SMITH. Thank you, I have no questions.

Senator SYMINGTON. General Bradley, we understood there are some supporting witnesses to your position. I join my colleague, Senator Thurmond. Yours was an impressive presentation.

Because of the problem of time, it occurred to us that it would be more propitious for Mr. Julian Lazrus to testify at this time.

Later, after he finishes, we will go on with the other witnesses. Perhaps you would care to introduce them to the committee at that time.

General BRADLEY. Yes, sir; I would like very much to. I only covered a very small part of these contributions, and these other witnesses have many more things to show you in the way of hardware.

Senator SYMINGTON. Is Mr. Lazrus here?

Mr. LAZRUS. Yes, sir.

Senator SYMINGTON. Have you a prepared statement?

Mr. LAZRUS. Yes, sir; I do.

Senator SYMINGTON. Would you like to read it?

Mr. LAZRUS. I would like to read the statement, if I might, sir, so that there might be an opportunity to question me on any items in the statement.

Senator SYMINGTON. Will you proceed?

Mr. LAZRUS. Thank you.

STATEMENT OF JULIAN LAZRUS, PRESIDENT, BENRUS WATCH CO., INC., NEW YORK, N.Y., APPEARING ON BEHALF OF AMERICAN WATCH ASSOCIATION, INC.

Mr. LAZRUS. Mr. Chairman, gentlemen, my name is Julian Lazrus, I am president of the Benrus Watch Co., Inc., of New York City. Benrus operates in the United States primarily as an importer of watch movements and an assembler of watches utilizing cases we manufacture in this country. Through its technical products division and various subsidiary companies, such as PIC Design Corp. and Technipower, Inc., Benrus is also heavily engaged in precision manufacturing, including substantial defense production as a contractor and subcontractor on such projects as the Sidewinder launcher, the Hawk, the Bullpup, Ranger 7, the Vortac aircraft traffic control system, etc. We think we, like thousands of other defense contractors, make a useful contribution to national security on a fully competitive basis.

I appear here today in my capacity as first vice president of the American Watch Association, Inc. The AWA speaks for more than 50 leading American companies which import movements and assemble watches for the United States and world markets. I would like to emphasize that we are American companies. Many of our firms operate facilities in Switzerland and elsewhere, as do Bulova, Elgin, and Hamilton, for example, but we are not "the Swiss industry," and we do not speak for the Swiss industry. We represent ourselves—a group of American companies employing thousands of American workers, owned by thousands of American stockholders, and paying taxes to the U.S. Government. We do not appreciate the implication that we are foreigners and, therefore, somehow less deserving of consideration than our competitors.

I am here today at the subcommittee's invitation to testify regarding the claims of certain watch firms that their domestic manufacturing capability is essential to the national security. We appreciate the opportunity to state our views, since these claims of "defense essentiality" have been closely linked for more than a decade to the efforts of the domestic watch manufacturing companies to obtain special protection from the Government against commercial competition from watch movements imported by members of our association and others in the industry.

The issue under discusion really has two aspects: First, is the domestic watch manufacturing industry essential to America's national security; and, second, is this security threatened by import competition? We plan to discuss both of these questions today.

THE "ESSENTIALITY" ISSUE ACTUALLY HAS LONG HISTORY

Because of the perennial claim of the domestic watch manufacturers that they are essential to the Nation's security and that they will be compelled to close their plants if the Government does not protect them from competition, the question of their essentiality has been examined many times. While members of the AWA have frequently expressed doubts about the validity of the claims of the domestic watch manufacturers that they possess unique production capabilities, we have consistently taken the position that this is an issue which cannot be resolved through debate between competing segments of our industry but which must be decided on the basis of objective consideration by impartial Government authorities with an overview of our technical needs, as provided for by law.

We recognize, of course, the sincerity of the arguments by the domestic watch manufacturers that they are unusually gifted in certain lines of defense production. However, all defense contractors, including ourselves, believe that they are making an important contribution to national security. And if a defense contractor faces import competition, the temptation is very strong to claim and to believe that such competition poses a threat, not only to the firm's business but to the Nation's security.

But if the United States is to avoid undermining its basic policies on international trade, such claims of defense essentiality must be carefully and critically weighed. Certainly, this has been done in the case of the watch industry. And although it is clear that the domestic manufacturers were unhappy with the Government's definitive ruling 6 years ago that they are not essential to the national defense, no one can legitimately contend that they were refused full opportunity to present their claims and to have them considered fairly and objectively at both the expert and policymaking levels of the Government.

The history of the watch industry's efforts to avoid import competition by claiming defense essentiality is an enlightening one. It dates back at least to 1954 when the Tariff Commission ruled, under legal standards then prevailing, that the domestic watch industry was being threatened with economic injury from import competition. Although it was theoretically not an issue for the Tariff Commission to consider, the Commission's report reflected substantial concern with the defense essentiality issue.

Shortly thereafter, a subcommittee of the Senate Armed Services Committee conducted a hearing explicitly to consider the defense essentiality question. Then, as now, industry witnesses predicted that U.S. national security would be seriously impaired if the domestic watch manufacturers were not protected against import competition. Representatives of the executive branch testified in support of the domestic manufacturers' claims; and a few days later, the Office of Defense Mobilization issued a report, based on an inquiry by an ad hoc interagency committee, which found that the domestic watch manufacturing industry was vital to the national defense and should be protected.

President Eisenhower's decision in 1954 to impose substantially higher duties on imported watch movements was believed at the time by most observers to have turned crucially on the "defense essentiality" issue. This interpretation was supported by the prominent mention given to the subject in the White House announcement of the President's action.

While all of this may appear to be somewhat ancient history in light of subsequent events, it may be of interest to you to recall that about 9 months after the President's action, at the request of a member of this committee, the Defense Department declassified the report which it had submitted to ODM in connection with its 1954 study. As a result it was unexpectedly revealed that the Defense Department experts had in no way supported the ODM's finding that the watch manufacturing companies were essential to national security.

Partly as a result of the dismay created by this revelation, a subcommittee of the Joint Economic Committee held extensive hearings in 1956 on the relationship between claims of defense essentiality and U.S. foreign economic policy. The watch industry case was the central focus of this study, although there were many nonwatch witnesses as well.

The Joint Economic Committee's report sharply attacked the ODM's 1954 ruling on grounds that it was "not accompanied by completely developed analysis of defense essentiality" and failed to employ "any set of recognizable criteria." This report played an important role in shaping events which followed, and for that reason I would like to file a copy of it with the committee.

As the Joint Economic Committee pointed out, the 1954 study of the watch industry's essentiality claims had been undertaken entirely on an ad hoc basis. It was not until the enactment of the 1955 Trade Agreements Extension Act that for the first time a definite administrative procedure was established for considering claims of injury or threatened injury to the national security as a result of import competition. Indeed, it was generally acknowledged that the watch controversy was one of the reasons for the establishment of this administrative procedure.

Following the enactment of this provision (sec. 7 of the 1955 act), petitions were filed in December 1955 and April 1956 by representatives of certain clock and watch firms asking for additional protection in the form of import quotas against what was described as "a continuing impairment to the national security." These petitions were considered by the Office of Defense Mobilization, the agency charged with administering section 7.

In view of the strong criticisms which had been directed at its 1954 study, ODM decided to reexamine its earlier finding. Accordingly, it undertook a definitive study of the horological industry's role in national defense—a study which is generally conceded to be among the most thorough analyses ever made into the defense activities and capabilities of a single industry.

To assure that there would be and could be no further challenge to its analytical procedures, ODM set in motion an interagency investigation lasting for more than 22 months—from April 5, 1956, to February 28, 1958—into all phases of the watch industry's defense essentiality claims.

The study included, for example, a review by the Defense Department of all contracts awarded to horological firms during a 6½-year period; studies of mobilization requirements by DOD and the Department of Commerce; surveys and field investigations by DOD teams of the firms claiming defense essentiality, of nonhorological firms engaged in related defense manufacturing, and of various defense contractors engaged in the production of missiles and missile-guidance systems; examination by the Labor Department of precision skills both in and out of the watch industry; independent studies by two outside consultants; public hearings at which 28 witnesses were heard on all phases of the issue; and finally a detailed analysis of all the data by the special Interagency Advisory Committee on the Watch Industry.

It is worth reiterating the fact that representatives of several of the agencies involved had testified before the Senate Armed Services Committee in 1954 that in their opinions the domestic watch industry was essential to the national security. Despite these earlier views, a painstaking and comprehensive examination of the facts by these agencies convinced them that their earlier opinions were incorrect, and they officially reversed their stands.

On February 28, 1958, the Office of Defense Mobilization announced its decision, which flatly and unequivocally concluded that the horological industry was not essential and that imports of horological products were not threatening to impair the national security.

The 1958 report, supported by detailed findings from each interested department, specifically rebutted every argument that had been put forward by domestic watch and clock manufacturers and their supporters in their effort to prove defense essentiality. In great detail, it utterly refuted the contention that watch manufacturing involved unique skills, unique machinery, or unique research necessary to the national defense. Indeed, so thoroughly were the industry's arguments disposed of that for the next 6 years there was a strained silence on the subject on the part of the domestic manufacturers.

Only in recent months, after the Tariff Commission announced its intention of considering the probable economic effects of restoring the pre-1954 duty rates, has the defense essentiality claim been revived in press conferences, in statements before the Tariff Commission, and now in testimony before this committee. But these companies have not, so far as we are aware, presented the facts for review by ODM or its successor agency, the Office of Emergency Planning.

As the committee knows, the national security clause was modified somewhat in 1958 and was continued as section 232 of the Trade Expansion Act of 1962. There is absolutely no indication that the provision has not been properly administered or that the watch industry could not again receive a fair and objective consideration if it had a valid case to present to the OEP.

This question of whether an industry is or is not essential to our Nation's security is extraordinarily complex and technical. It certainly is a question that cannot be settled on an informed basis following a few hours of hearings, such as are being held here today. If Bulova, Elgin, and Hamilton believe that circumstances have significantly changed since 1958, so that the ODM's conclusion is no longer valid, the logical thing for them to do is to file their claim with the OEP, so that the orderly procedures which the Congress has provided under the law can be followed.

Certainly, their mere assertions that they are essential can scarcely be assigned much weight when compared to the extensive and explicit factual findings which Government specialists handed down in 1958 after investigations lasting 22 calendar months and innumerable man-years.

SUMMARY OF KEY FINDINGS IN 1958 DECISION

Because they have a direct bearing on the claims which are currently being advanced by Bulova, Elgin, and Hamilton, I would like to take just a few moments to discuss certain of the official departmental findings incident to the ODM study:

(1) The Deputy Secretary of Defense, in a letter to ODM dated February 8, 1958, observed that—

> the horological industry has a good record of military support, and on a competitive basis we will use them whenever we can.

However, he added—

> the Department of Defense does not consider that it would be necessary to rely upon the horological industry for any substantial contribution in support of a possible future national emergency. It is our conclusion, therefore, that the horological industry is not essential in the supply of items critically needed by the Department of Defense in times of national emergency.

In other words, a clear distinction was drawn between competitive participation in defense contracting and essentiality to the national defense. A firm or an industry can make a useful contribution without being indispensable.

(2) With respect to the specific claims of the jeweled-level segment of the horological industry, the Secretary of Defense, in a letter to ODM on September 19, 1957, concluded that—

> the facts which we have assembled, based on the latest available mobilization requirements estimates and the findings of a study of missile contractors, do not indicate major dependence upon the jeweled watch segment of the horological industry to meet defense requirements.

Indeed, the Department's summary of field visits to all of the major missile manufacturers showed that—

every missile firm had good sources of supply completely outside of the horological industry for every item listed by the jeweled watch industry * * *. Not a single report of the four survey teams supports the contentions of the jeweled watch industry that it is essential to missile development or production.

(3) The Defense Department noted that no significant distinction could be drawn between the relative capabilities of the jeweled-lever watch manufacturers and the producers of pin-lever watches and clocks. In this regard, the Assistant Secretary of Defense for Supply and Logistics, in his report to ODM on February 5, 1958, observed that "this office would not attempt to distinguish which segment (of the industry) ultimately would be used more" for procurement of defense items. Indeed, the only product for which no alternative sources outside of the horological industry were listed by missile manufacturers was the U.S. Time Corp. gyroscope. (The Assistant Secretary's report noted, however, that "a separate study of gyroscope requirements * * * concluded that there is adequate capacity to meet mobilization needs without dependence upon the U.S. Time Corp.")

(4) As to the alleged uniqueness of the domestic watch industry's capabilities in the field of miniaturization, the DOD's Director of Guided Missiles advised that "any unique or peculiar capability the watch industry may have had in the past is rapidly being duplicated by other industries which have demonstrated a capability of equaling and even exceeding the precision and miniaturization work of the watch industry." The survey of missile manufacturers was even blunter: "Precisions for the missile systems frequently exceeded the capability of the jeweled watch industry." Not only were the manufacturing capabilities of nonhorological firms such as IBM, Univac, and Sperry-Rand cited, but the Secretary of Defense in his letter to ODM of September 19, 1957, also observed "that watch importer-assemblers can contribute to Defense requirements and that one of these companies has performed in its domestic plant over $80 million of prime and subcontract defense work since 1951."

(5) Finally, concerning the alleged essentiality of certain skills required in domestic watch manufacturing, the Labor Department, as summarized in the ODM decision, found that "in most of the skills examined, with a brief training period, there was relative ease of interchangeability between the jeweled and pinlever segments of the horological industry, and with training periods of varying lengths, there could be some interchangeability of key skills between precision manufacturers outside the horological industry and those within the horological industry." In view of the fact that this study had concentrated on nine skills agreed upon by jeweled-lever manufacturers themselves as critical, this was certainly a most damaging blow at the core of the industry's case.

I have cited only a few highlights from the remarkably comprehensive analysis undertaken in connection with the ODM investigation. Because it represents the most recent official study of the subject, as well as by far the most thorough, we respectfully request, Mr. Chairman, that a copy of the February 28, 1958, decision by the Office of Defense Mobilization be incorporated in the record of this hearing, together with the supporting memorandums, letters, and reports prepared for ODM by the Department of Defense, the Labor Department, the Commerce Department, and outside consultants. Since there may be some difficulty in obtaining certain of the supporting documents, we would be happy to supply the subcommittee, if it desires, with a full set for the printed record. (This information, subsequently submitted, will be found in app. I, beginning on p. 89.)

Senator SYMINGTON. Without objection, that will be done. Because of the tremendous changes in the art of defense since 1958, I would ask your and the committee's approval to let the people who believe in maintaining this production base in this country file anything they have to say in the same place, after your filing.

Mr. LAZRUS. Of course, sir.

Senator SYMINGTON. Without objection.

Mr. LAZRUS. Representatives of the domestic watch manufacturers argue that developments since 1958 have increased the importance of a domestic watch manufacturing capability to the national security. As I have already indicated, I am not prepared to make a detailed statement regarding the current defense essentiality claims made by the domestic manufacturers. I think it would not be my position to do so. But I would be much surprised if these claims of increased essentiality were found to have any validity. In fact, the opposite seems to be true.

For example, in various statements to their stockholders in recent years, the jeweled-lever watch manufacturers have said that their sales and generally their profits in the watch field have been increasing, but that they have suffered as a result of cutbacks in their defense business. Similarly, in sworn testimony before the Tariff Commission in recent months, the president of Bulova and Hamilton testified that they could not look for much help from their defense contracts because of what was described as the "feast or famine" character of the defense business. Since defense spending for research and procurement has certainly not decreased over the past decade as a whole, the "feast or famine" comment suggests either that some of the defense items which the watch manufacturers are able to produce may no longer be needed by the Government, or that, increasingly, there are other component suppliers available, who offer the watch manufacturers stiff competition for defense contracts. I suspect that both of these are true, and both would indicate that the domestic watch industry has become less important, not more important, to the national defense.

An interesting case in point is the bid opened August 29, 1961, by the Ordnance Ammunition Command, Joliet, Ill., for the M–525 and M–527B1 point detonator fuses. This is an item similar to those for the production of which the domestic jeweled-level manufacturers claimed they were essential in earlier hearings. There were 38 bidders for this contract, of whom only 6 were part of the horological industry. Of the 12 lowest bidders, only 4 were part of the horological industry, and 2 of the 4 were Benrus and Longines, who are importer-assemblers and members of the AWA. I would be happy to furnish additional examples if the subcommittee desires.

So far as future defense work by the watch manufacturers is concerned, it is significant that Mr. Margolis, the president of Elgin, testified before the Tariff Commission just a few weeks ago that Elgin had decided to phase out of the defense contracting business. This decision had no relationship to import competition on watches. Instead, it followed upon Elgin's reported loss of some $3.5 million in defense work, and a subsequent proxy fight within the company.

In short, Elgin plans to stop bidding on defense work henceforth, while Bulova and Hamilton have found that they are meeting increasing difficulties winning contracts in bidding against other watch and nonwatch companies for the kinds of research and production now sought by the Defense Department. Moreover, under current DOD policies, deliberate efforts have been made, as I understand it, to avoid reliance in general on sole-source procurement. Thus, it has been my observation as a defense supplier that in many fields of technology, capabilities have been deliberately and successfully spread by this policy among a wide variety of industries. This includes the technology in which the horological industry specializes. An example which is very close to home is the PP–2315 power supply for the new generation Sidewinder launcher, which was originally developed by Benrus in competition under a development contract from DOD. Today, because of DOD's procurement policies, there are now other companies besides Benrus which are fully capable of bidding on this and similar contracts.

All of this leads us to suspect that the defense essentiality claims of the domestic watch manufacturers are less supportable today than in 1958. But even beyond the question of essentiality is the question of injury.

I should now like to turn briefly to the question whether there is any serious economic threat caused by imports to the defense capabilities of domestic horological manufacturers. We recognize, Mr. Chairman, that this committee is not looking into the economic status of the industry in ordinary terms of the tariff. However, the domestic jeweled-lever manufacturers have sought to create the impression that the skills of the horological industry are in jeopardy as a result of imports, and this simply is not a correct picture.

It is important, at the outset, to understand that the American horological industry includes a wide spectrum of products in addition to jeweled-lever watches. Some horological companies concentrate on the production of clocks, some on pocket watches, some on industrial timers, some on automobile clocks, some on pin-lever wrist watches, and some on jeweled-lever watches. Some companies produce several types of horological products.

It is generally acknowledged that no basic distinction can be drawn between the defense production skills of the various segments of the horological industry. All of these companies are capable of producing essentially similar defense equipment, and all have capability with respect to miniaturization and precision manufacturing. Mr. Arthur Sinkler, president of Hamilton, acknowledged this fact during the Joint Economic hearings in 1956. Mr. Albert Reeves, of the Clock & Watch Manufacturers of America, had commented that his industry—

> has a degree of essentiality which is peculiar to it and which is not exceeded by any other branch of the horological industry.

Mr. Sinkler promptly spoke up to say:

> The jewel watch industry concurs with what Mr. Reeves has just said, that nothing we might have said infers that the jewel-watch industry is essential to the exclusion of the nonjewel parts * * *. Mr. Reeves' industry is equally essential.

The same conclusion was reached by ODM, the Defense Department, the Labor Department, and by this committee in its 1955 report. In other words, any examination of defense essentiality for this industry must consider not only the jeweled-lever producers but clock manufacturers and pin-lever watch manufacturers as well.

When the U.S. market for horological products is examined in its broad scope—which is clearly the only proper way to consider it from the standpoint of defense production capability—it will be seen that the domestic manufacturers totally dominate the market and are in no way threatened by imports.

In the clock field, for example, an American company—General Time Corp.—advertises that it is the largest producer of timepieces in the world. Its products not only dominate clock sales in this country but overseas as well. General Time is a very substantial defense contractor and bids on defense contracts similar to those solicited by Bulova, Elgin, and Hamilton.

Even looking at the watch field alone, contrary to the claim that the U.S. market is dominated by the Swiss industry, the fact is that domestic manufacturers last year sold 59 percent of all watches sold in the United States. This is an appreciably greater share of the market than the domestic manufacturers controlled 10 years ago.

Total U.S. watch sales in 1962 and 1963 were at their alltime high of about 26 million units, 60 percent above the level in 1954. Moreover, sales of watches containing domestic movements accounted for nearly one-half of all watches sold in this country in 1963.

Approximately 12.2 million watch movements were manufactured in the United States last year, about 38 percent more than the U.S. output in 1953.

We estimate that in 1963 approximately 1.9 million jeweled-lever watches were produced in the United States—14 percent more than the domestic output in 1954.

Similarly, we estimate that in 1963 approximately 10.3 million pin-lever watches were produced in the United States—about 87 percent higher than the output in 1954.

I also have with me, and will be happy to furnish the subcommittee, various charts and statistics which were submitted by the AWA to the Tariff Commission in May and which graphically demonstrate the large share of the market dominated by the domestic industry.

Senator SYMINGTON. Would you like to put those in the record?

Mr. LAZRUS. I think it might be desirable, sir.

Senator SYMINGTON. Very well.

(The charts and statistics above referred to will be found beginning on p. 252.)

Mr. LAZRUS. Bulova, Elgin, and Hamilton claim that these figures should be disregarded. They say that the largest U.S. producer of watch movements, the U.S. Time Corp., should not be considered a part of the domestic watch industry at all. They base this on the fact that U.S. Time imports a portion of its watch parts requirements from its overseas plants for use, together with domestically produced parts, in its U.S. watch production. Bulova, Elgin, and Hamilton have the facilities to make almost all of their parts in this country—although they do import a number of parts and all of the jewels used in their domestically manufactured movements.

U.S. Time is simply doing what many of the most successful American manufacturing industries also are doing—turning to outside sources for certain components when it is more efficient to do so. As Henry Ford II has said:

American industry and European industry must, and I am certain will, increasingly source abroad and shop the world for the most economical values not only in finished products but, just as importantly, in parts, materials and accessories * * *. If we keep ourselves competitive in world markets, we have everything to gain from selective international sourcing * * *. In many instances, importing a low-cost part or component may make it possible to manufacture in our country a complete product that otherwise would have to be produced abroad, or not at all.

About 50 percent of the parts of a Ford or General Motors car are purchased by the automobile manufacturers from independent suppliers in this country and abroad. U.S. Time is just as much a part of the American watch industry as Ford and GM are part of the American automobile industry.

Even more important, from the standpoint of our national security, which is this committee's special concern, U.S. Time provides skills and production capabilities at least as significant as those of Bulova, Elgin, and Hamilton. For example:

1. The 1955 staff report of the Senate Armed Services Committee dealing with the defense essentiality of the watch industry clearly included U.S. Time and other pin-lever producers as part of the domestic industry. It is noted that the skills of these companies, though not identical, were similar to those of the jeweled-lever manufacturers.

2. In 1958, the Office of Defense Mobilization found no essential differences between the pin-lever producers' contribution to our country's defense and that of the jeweled-lever companies.

3. The Labor Department report to ODM in 1958 concluded that the skills of U.S. Time and other pin-lever manufacturers were reasonably interchangeable with skills in jeweled-lever production and with skills in other precision industries.

4. U.S. Time at present produces approximately 8.5 million movements a year—about one-third of all the watches sold in this country—and employs more workers than all other U.S. watch manufacturers combined. It has doubled its employees in the last 10 years. It thus possesses by far the largest pool of skills and production capability in the industry.

In short, from both an economic and a defense standpoint, U.S. Time must be considered an important part of the domestic watch industry. Consequently, if the resources of this industry are essential to our security, those resources not only are being maintained, but are growing at a rapid rate.

The question whether the domestic watch industry has been or may be injured by import competition currently is undergoing intensive examination under the appropriate procedures provided by law. In three separate proceedings before the U.S. Tariff Commission, the relationship between imports, duties, and the condition of the U.S.

watch industry is being thoroughly investigated. Bulova, Elgin, and Hamilton have been afforded ample opportunity to present to the Tariff Commission their claims that watch imports are injuring the domestic industry and that higher duties or import quotas should be imposed. I am sure that if the Commission finds that domestic producers are entitled to additional protection, it will do its duty under the law and recommend appropriate relief. The President and his advisers will carefully review the advice of the Commission before taking any action and can be expected to exercise due regard for the national interest including, certainly, protection of the national security.

There is likewise an administrative procedure for offering and testing claims of exactly the sort which have been asserted here today. Much has been said, for example, about the importance of the Bulova Accutron. The Accutron certainly is an admirable timekeeping achievement, but we would strongly doubt that it renders the entire industry essential to our national defense when it was not essential in 1958. However, the domestic producers have every right to present a petition to the Office of Emergency Planning for a review of the facts and, if the evidence requires a further investigation, we are confident the OEP will institute a new study promptly.

Thank you.

Senator SYMINGTON. Thank you, Mr. Lazrus.

That was an interesting statement.

Senator Jackson, have you any questions?

Senator JACKSON. Have the others?

Senator SYMINGTON. Do you want to wait?

Senator JACKSON. No. That is all right.

Mr. Lazrus, I appreciated your statement. You have gone into it very thoroughly.

It seems to me—and I just put this to you for what it is worth—that if another country already has 86 percent of the market, isn't it somewhat reasonable or sensible that regardless of speculation as to the importance of the watch industry, from the standpoint of defense, we ought to have a margin here of competition, talent, and know-how, because we don't know what the future will hold?

Mr. LAZRUS. Well, as I pointed out, sir, that 86 percent is not 86 percent of the watch market.

Senator JACKSON. I understand that. But I am talking about the pieces that go into the watches.

Just as a matter of commonsense—I am not wise enough or smart enough to know what can come out of the minds of men working in this talented area.

I was somewhat impressed by the importance of competition, that Switzerland, which has done a great job in timekeeping, however, has not come forth with any great new achievements in the horological field. The Accutron and the electric watch by Hamilton are essentially American achievements.

Isn't there some merit in having a yardstick or some competition? This is what I am talking about.

Mr. LAZRUS. It is interesting to note that in a recent advertisement of Bulova in the oversea market they specifically state that the Accutron was developed by a physicist in their Bienne Laboratories, which is in Switzerland.

General BRADLEY. I will answer that, if I may later.

Senator JACKSON. Could you answer it now?

General BRADLEY. Yes, sir.

The idea of the Accutron was originated by one of our employees in our Bienne plant. But he did not have the technical and the electronic know-how to finish it. So we brought it to this country and put it in our own electronics shop, and worked on it with our own horological people. We brought him over here to help. It was primarily, though, by the people in our own shop that the Accutron was developed. It never could have been developed in our Bienne plant alone, because they do not have the electronic know-how. It took us 8 years then to finish it and get it ready for the market.

Senator JACKSON. Well, Mr. Lazrus, that in my mind would indicate that if you get too much of a monopoly in one thing, there is a tendency not to try something new—that if this idea germinated in Switzerland, why didn't it reach fulfillment by other companies?

Mr. LAZRUS. Well, I think there is very ample patent protection, among other things, for Bulova on the Accutron device, which would effectively keep someone else from working in that particular field.

Senator JACKSON. Once they got it. But I am saying if this was a Swiss idea, why didn't it germinate into fulfillment in Switzerland?

Mr. LAZRUS. I think because it was under the control of the Bulova Watch Co.

Senator JACKSON. Well, but surely there are other great talents. What about the electric watch?

Mr. LAZRUS. The electric watch was developed almost simultaneously, as a matter of fact, here and abroad in different forms.

The concept of an electric watch has been known for many years, sir. As a matter of fact, if you examine the record, you will see that a friend of mine and I own a patent on an electric watch device going back to 1948.

It is interesting with respect to competition to find that within the last few years that Timex has gone into the jeweled lever watch field and has initiated a plant for the production of jeweled lever watches.

So that I think that the industry has to be considered as being actually a going industry at the present time.

Senator JACKSON. Well, of course—I don't know—there are figures I noticed here—Senator Symington called them to my attention—which show a decline.

But we can get lost in figures, you know. There is a philosophy that concerns me, frankly, and that is the need for a yardstick, a measurement of competition, the maintenance of competition in an area that can bring into being some entirely new systems. This is what concerns me.

And I just wonder how far we should go in permitting that competition in this country to erode to the point where the opportunity to bring into the marketplace, both from the standpoint of domestic use, and possibly with some military implementations—disappear from the scene.

This is what concerns me, frankly.

I mean would you go for all the market going? I mean it is going this way.

Mr. Lazrus. I think that you are asking me a question which is probably beyond my competence, sir. I think that the thing there is that it is the Congress which establishes the laws, and it is the Tariff Commission and the Defense Department and the various other parts of the executive branch who have to carry them out in accordance with your wishes.

I think it would be really presumptuous of me to try to—except maybe by my single vote in November—to indicate one way or another as to whether or not I agreed or disagreed.

Senator Jackson. That vote in November might be confusing. [Laughter.]

I am a layman, but I hope I have a little sense. I am just wondering if there isn't some merit in the idea of having at least some measure of competition here in an area of our scientific, industrial endeavor that can lead to new systems, both in domestic use and possibly military use.

This is what concerns me. I don't have the time, nor do other members of the committee, I am sure, to absorb all the detailed figures.

But we do have before us this fundamental question that many of us have observed in other fields over a period of many years.

I have discovered that the more competition you get of ideas as well as in a free enterprise vote, the more they are on the ball.

I might observe that back in 1949 I was on the Joint Committee on Atomic Energy. I was one of the members of the committee, and the House at that time felt that we should have more than one weapons laboratory, that Los Alamos was a great weapons laboratory—but we thought that it would be healthy to have another one.

So we set up Livermore. And out of that competition of ideas have come a great addition to our weapons backlog. I mean, our weapons stockpile.

I saw this with my own eyes over a period of many years. And I have served as chairman of the Atomic Weapons Subcommittee.

Mr. Lazrus. I think you have touched on two things there that are extremely important in this regard. One of them is that the Government does have the procedure established for just the type of study that you are talking about to be made.

And one of them is being made presently by the Tariff Commission, who are empowered by law to make the kind of a study to determine whether there is indeed a hurt.

In terms of this question of essentiality, the OEP is specifically entitled to make this study, as I indicated.

And finally, in terms of the last thing you mentioned, which is competition, I think that, as we as defense contractors have come to learn, the Department of Defense does make every effort to make sure that there are alternative sources of supply, in order to reduce the uniqueness of any individual company or any individual resources.

And except in those instances where perhaps there is some other kind of protection, such as patent protection, and so on, in general I would say that the Defense Department has done an excellent job improving the scope of this. We ourselves have seen this on items which we perhaps originally developed.

We find that as we go along, the number of sources that continually compete against us grows larger and larger as the item gets into the field.

And much of this—well, it is obviously not our doing to create our own competition. But the Defense Department does a good job of insuring we are not alone, even though sometimes they have given it to one of their own facilities at a greater cost.

Senator JACKSON. I agree more people are getting into this. But what I am referring to is the germination of ideas. If you withdraw talent from certain areas within our own country, I am wondering if it doesn't have an effect.

It seems to me there is some relationship here, in the state of art of the horological industry and the development of entirely new concepts.

I think you have made a fine statement. I am just concerned about the broad philosophical problem that could have-long term impact on our defense structure.

And incidentally, while we of this committee are not experts, we do have to make some reasonably important decisions. While we may not likewise be set up by law to pass on this, we do have under the Constitution a certain responsibility, I might mention, that has been there since the founding of the Republic.

And therefore maybe our judgment is a matter of concern which the Tariff Commission, I would think, would want to at least take a quick look at for their own interest.

Thank you, Mr. Chairman.

Senator SYMINGTON. Senator Smith.

Senator SMITH. I have no questions.

Senator SYMINGTON. Senator Thurmond.

Senator THURMOND. Mr. Lazrus, you have made a very effective statement from your point of view. I am very much concerned, though, when any industry in this country has lost 86 percent of the market in this country—especially when it is concerned with national defense.

In 1963 I believe the Waltham Co. went out of business, did it not?

Mr. LAZRUS. The Waltham Watch Co. ended up, sir, I believe as two separate companies, actually.

The Waltham history, of course, is not totally related to competition. It relates in some measure to the management of the company.

However, it did split off into two parts, one of which remained in the watch business, and the other part, Waltham Precision Instrument, is still in business, still doing a great deal of defense work, and as a matter of fact, they are neighbors of ours in Connecticut, and competitors of ours.

Senator THURMOND. Well, they did cease U.S. watch production.

Mr. LAZRUS. Yes, sir.

But, again, I don't think that that was due to imports. I am somewhat familiar with the Waltham situation. They occupied at the time they went out of business a plant which was almost 100 years old, some parts of it. They were using machinery which was obsolete. They did not use even certain machines which they bought and never put to use, for some strange reason.

Senator THURMOND. Do you think they would have ceased watch production in this country if they had been making money?

Mr. LAZRUS. I think they would have ceased production in this country because they were competing with other domestic manufacturers—even if there had been no imported watches, sir, I think that the Waltham Watch Co. as it was then set up would have gone out of business because I am sure that Bulova, Elgin, Hamilton, U.S. Time, would have beaten them to death on their own.

Senator THURMOND. Now, in 1954 I believe the employment of watch workers was 4,300. In 1963, 2,684.

Mr. LAZRUS. I believe those figures that you have there, sir, exclude U.S. Time, whose production and whose employment I believe greater than the total you have given there, by almost double, or more.

Senator THURMOND. Of course, U.S. Time gets some of its parts from its plants overseas.

Mr. LAZRUS. They do get some of their parts from their plants overseas. However, they completely assemble the watch here, and they manufacture over half their parts here, as I understand.

Senator THURMOND. I am speaking of the jewel watch industry.

In 1951, I believe the production of watch movements was 3,162,000.

In 1954, it was reduced to 1,716,000.

And in 1963 to 1,393,000.

Mr. LAZRUS. There are two things there sir.

First, I believe that that excludes U.S. Time's jewel-level production, in the first place.

And secondly, you must understand that the watch market, like any other commodity market——

Senator THURMOND. I am speaking of the jewel watch industry.

Mr. LAZRUS. Yes, sir.

But the jeweled watch industry changes, or the watch industry changes. A few years ago people were buying nothing but small cars, and the compact cars came into being, and people bought compact cars like mad. The result was that there was a change in the buying habit of the consuming public.

We have had a similar thing occur in the watch industry where we have seen U.S. Time's production of watches in a period of 10 years practically quadruple, as the public has, as a result of advertising, marketing, and, I must confess, improved product, turned more and more for a less expensive product to wear on their wrist.

I don't particularly like that. I find that they are exceedingly difficult competition, too. But that does not mean that they are not a part of the industry, and it doesn't mean that in day-to-day business I don't compete with them.

We compete with them very heavily whenever we possibly can. Even some of my confreres in the industry here must feel that they compete directly with them, because I have seen many of their advertisements which are directly aimed at U.S. Time, and the U.S. Time Watch concept.

They are not just in competition with imports. They are in competition with Timex, too.

Senator SYMINGTON. Will the Senator yield?

Mr. LAZRUS. Anyone that has taken that big a share of the market, has to have made a dent in everybody else.

Senator SYMINGTON. Mr. Lazrus, would you say that the work done by the U.S. Time people in competition with Benrus and Bulova makes for more accurate specifications, or less?

This committee is interested in the extreme accuracies required in the new defense weapons.

It is my understanding you attain more accuracy through jeweled movements than through nonjeweled movements.

If that is true, the increase in the amount of business that is being done by U.S. Time, using your own definition of small cars—there are many things you do not get in a small car you do get in a large car.

I notice the comments of Mr. Webb of NASA.

I was wondering, therefore, if you feel from strictly a defense standpoint, the U.S. Time increase in production is comparable to future needs in jeweled movements for the Defense Department and the space agency.

Mr. LAZRUS. I think there are two answers to that. First, I think that Timex is certainly becoming a much more precise manufacturer than they ever were in the past. That is certainly true. Their product is better.

In terms of precision manufacturing of long-run items, I think that they do a very important job. I wish I did as well.

In terms of the innate precision of watches, however, I would like to tell a story, if I may.

Back in 1941 I was working at our factory in Waterbury, and I had occasion to go to see the old Sperry Gyroscope Co. in Brooklyn, because we were doing a job for them. The guy I was talking to got very annoyed with me and he said, "You know, the trouble with you people in the watch business is you don't know what precision is." The fact is that those precise, those highly precise things we make today, whether they be very tiny torsion bars, or whether they be items for research centers—these things are far beyond the scope of the basic watch industry. And I believe that there are many other people like our own particular factory in Waterbury who specialize in these highly precise, close dimension items.

Senator SYMINGTON. Are you saying you can make a more precise nonjeweled watch than you can a jeweled watch?

Mr. LAZRUS. If you set out to make a high precision, nonjeweled watch, it would be possible to do so.

Senator SYMINGTON. I am cooling out on buying jeweled watches, if you are right.

Mr. LAZRUS. This is one of our problems, sir.

General BRADLEY. Mr. Chairman, may I add something here? I think it might shorten this a little bit.

We include these other people the pin-lever producers, in what we are talking about today. We think they are essential, too. We are not limiting our argument to jeweled watch companies alone.

You will hear later on a representative of General Time, and there will be a statement from Ingraham. We are including all those people. We think they are essential also.

Senator SYMINGTON. I had seen the figures Senator Thurmond has. They are divided into jeweled and nonjeweled.

I was wondering whether we were talking about jeweled watches only, or jeweled and nonjeweled.

Proceed, Senator, and thank you.

Senator THURMOND. Mr. Lazrus, in the jeweled watch industry, I believe the output capacity in 1954 was 47 percent. And in 1963, 57 percent, showing an increase there in the unemployment.

Now, as to profits, profits as a percentage of sales of the jeweled watch industry, in 1954 it was 3.4 percent; in 1963, 1.4 percent.

In the jeweled watch industry the share of the U.S. market for jeweled lever watches, 1954, was 19 percent; in 1963, it was 14 percent.

You see these figures all show a picture, I think.

The number of companies has decreased. Waltham has gone out of business. Employment on watch work has decreased. The production of watch movements has decreased, as I said, from 3,162,000 in 1954 to 1,393,000 in 1963.

The idle capacity has increased. The profits as a percentage of sales have gone down.

A company cannot stay in business if the profits as a percentage of sales keep on the trend that this indicates here.

And the share of the U.S. market for the jeweled lever watches has decreased.

In other words, the jeweled watch industry is being hit to such an extent that it will soon be extinct unless something is done.

Now, it is important to our national defense? If it is, then it seems to me there is a burden of responsibility for steps to be taken to see that it does not become extinct.

What would we do if we should get in a war, an emergency, and could not get these parts from overseas that you speak about now, that we are getting or could get. Suppose we are cut off entirely. Then where would we be?

Now, I believe according to the information I have it takes as much as 10 years to train some tool and die makers. Now, that is a long time in this day of atomic war—you would not have the time to do that.

It takes 10 to 20 years to establish an integrated jeweled watch plant.

Now, as to national defense, the information I have is that the Bulova Co., the Elgin Co., the Hamilton Co., and the General Time Co. have done or are doing research or engineering and produce parts or components for 48 out of a total of 62 missiles shown—that is 77 percent—of which some are still in the research stage and others are no longer in production.

Thirty-four out of forty-nine in service use—that is 88 percent.

And 18 out of 19 shown to be in production, which is 94 percent.

Now, the three jeweled watch companies also have designed and have produced important components in the following spacecraft: Apollo, Gemini, Nimbus, Relay, Telstar, Tiros, Mariner, Ranger, Surveyor Lander, Explorer, Discoverer, and Syncom. And in addition, these companies have designed and/or produced timers for bombardment rockets, delayed arming devices for high-altitude bombs, demolition timers, delayed triggering devices for land and underwater mines and demolition charges, inertia switches for rockets, elapsed time indicators, and safety devices to prevent misfire of naval ship weapons by the ships own radar.

And in addition to complete components the industry furnishes a great volume and variety of miscellaneous parts and subassemblies to a host of Government prime contractors and subcontractors.

Now, I could go on and tell other things. But these are just illustrations which to my mind show that the jeweled watch industry is a vital segment of our defense industry.

And it would be a great mistake for it to become extinct. And it is becoming extinct.

We are not opposing what you are doing. Undoubtedly you are helping—in time of emergency you would be in a position to help. The point we are getting at is what is happening to the jeweled watch industry which is becoming extinct, and which is playing such a vital role in our defense establishment.

Now, that is what we are driving at. And that is what we are trying to show and bring out here.

Thank you very much.

Thank you, Mr. Chairman.

Senator SYMINGTON. Mr. Lazrus, one point, please, to clear me up on.

You quote on various defense projects yourself and obtain business.

Mr. LAZRUS. Yes, sir.

Senator SYMINGTON. Benrus does.

Mr. LAZRUS. Benrus does.

Senator SYMINGTON. And you are primarily an importer?

Mr. LAZRUS. Our setup is as follows, sir: We have movement manufacturing plants which are in Switzerland. We have a watchcase manufacturing plant in Waterbury, Conn. We have a facility in Waterbury, Conn. for the manufacture of certain electronics gear—most of it—some for the FAA, but various other elements of the aircraft industry, and so on.

We have another facility just outside, or in another section of Waterbury which is devoted to all practical intents and purposes to airborne stores-carrying equipment, including Sidewinder launchers, the Bullpup launcher, LAU-7.

We have, incidentally, supplied around 15,000 power supplies for Sidewinder launchers at the inception. This is a two-way street in world trade incidentally, since last year we supplied——

Senator SYMINGTON. Before we get into world trade, let me ask the question this way.

Mr. LAZRUS. We supply not only this Government, but others.

Senator SYMINGTON. If you took an order for manufacturing a watch movement, from the American Government, have you the facilities to produce those movements in this country?

Mr. LAZRUS. No, sir; we do not.

Senator SYMINGTON. Then would you build them abroad, or would you not quote on such a request to bid?

Mr. LAZRUS. On a watch movement per se? On a watch movement per se, if we bid, we would have to stipulate that it would come from our plants abroad.

Senator SYMINGTON. If you eliminate the industry in this country, how would you handle it after the industry had left?

Mr. LAZRUS. I think the assumption that the industry is a dying one is sort of belied by the fact that one concern alone takes up a third of the market, and they are right here.

Senator SYMINGTON. What concern is that?

Mr. LAZRUS. That is U.S. Time.

Senator SYMINGTON. But then don't we get back into the question of whether you do or do not need jeweled movements for high-precision instruments?

Mr. LAZRUS. I personally do not believe that the rest of the domestic watch industry is dying, either.

From a competitive standpoint, I know what it—the prices at which they sell——

Senator SYMINGTON. I didn't ask you that question. I asked you whether or not, for maximum precision, you do or do not need jeweled instruments.

Mr. LAZRUS. A jeweled lever watch is more precise presently than a nonjeweled watch—correct.

Senator SYMINGTON. Thank you.

You have made a fine presentation of your position.

Mr. LAZRUS. Thank you, sir.

Senator SYMINGTON. Any further questions from any other members of the committee?

Thank you, Mr. Lazrus.

Mr. LAZRUS. Thank you, sir.

Senator SYMINGTON. General Bradley, would you like to introduce these additional witnesses?

General BRADLEY. Mr. Chairman, may I suggest a change in order. I don't know how much time you have. We have representatives——

Senator SYMINGTON. If necessary we will meet this afternoon.

General BRADLEY. May I suggest that the committee hear Mr. Draper from Sandia first, and then we follow with the other watch witnesses?

Senator SYMINGTON. Fine.

STATEMENT OF E. H. DRAPER, VICE PRESIDENT, DEVELOPMENT, SANDIA CORP., SANDIA BASE, ALBUQUERQUE, N. MEX.

Mr. DRAPER. Mr. Chairman, my name is E. H. Draper, I am vice president for development, Sandia Corp., Sandia Base, Albuquerque, N. Mex.

I wish to express my appreciation to this subcommittee for its invitation to appear at this hearing because of the importance of the watch industry to the nuclear ordnance program.

Under a prime contract with the Atomic Energy Commission, Sandia Corp. operates two major ordnance engineering laboratories: Sandia Laboratory at Albuquerque, N. Mex., and Sandia Livermore Laboratory at Livermore, Calif.

Sandia Corp. designs, develops, tests, and monitors production of nearly all components and systems in U.S. nuclear bombs and warheads, except the nuclear systems. The nuclear systems are designed either by the AEC's Los Alamos Scientific Laboratory or the Lawrence Radiation Laboratory at Livermore, both operated for the AEC by the University of California. In the course of developing a bomb or warhead around these nuclear systems, Sandia works closely with the Department of Defense's aircraft or missile contractors to assure compatibility of the weapon with the delivery system.

One of the activities performed by Sandia Corp. is the development of fusing and firing systems for nuclear bombs and warheads. Since the measurement of time is a factor of such systems, Sandia is concerned with many types of timing devices.

The jeweled detached lever escapement is the regulating device employed in one type of timer used by Sandia. The escapement is patterned after the Hamilton Watch Co.'s pocket-style railroad watch and utilizes several of its standard parts. Timers utilizing this regulation method have features making them desirable for certain military applications. Such timers are capable of meeting the normal range of military environments, utilize little or no electric power, are immune to radiation, and have a long stockpile life. Furthermore, they have long timing capability, are accurate, and are of small size and light weight.

The jeweled detached lever escapement used in this timer contains a relatively small percentage of the total number of piece parts which comprise a Sandia timer, but the escapement is the heart of the timer and is most critical in terms of overall performance. The escapement is made up of extremely small, closely toleranced parts requiring very precise tooling and control in their production. Only when these precision parts are properly inspected, assembled, adjusted, and tested can the escapement perform properly in the exacting environments of our military requirements. While many American industries have the capability of developing and manufacturing the nonescapement parts of the timer, it is only in the American watch industry that Sandia Corp. has found readily available the machines and tooling to manufacture the precision parts of the escapement and even more essentially, the craftsmen with the needed horological skills and techniques.

A timing device using a jeweled detached lever escapement has been part of the four recent weapons systems placed in the Nation's stockpile. Three of these systems contain a timer produced by Bulova Watch Co. where the systems requirement dictated the use of a small lightweight and accurate timing device. The fourth system utilizes a timer produced by Hamilton Watch Co. where long timing capability and accuracy were prime necessities. And in all four, the state of the art was severely pressed in making a device meeting shock requirements many times in excess of commercial requirements and operating without oil lubricants.

Sandia Corp.'s need for timers is not expected to diminish in the future. Many advances have been made in devices for the measuring of time, especially in the electronics field. However, timers utilizing jeweled detached lever escapements may continue to offer definite advantages not afforded by other devices, such as immunity to nuclear radiation and spring-powered escapements for use wheer electrical power within the weapons system is limited or unavailable. With the expected continuing need for such timers, and the pressures to develop beyond the known state of the art, an industry skilled in the manufacture of detached lever escapements is required. While, with the expenditure of time and money, firms in the United States outside the watch industry could produce the parts required for a timer and perhaps even those needed in the critical escapement, the essential skills and techniques of the craftsmen in the watch industry cannot be so duplicated. Should the present generation of these craftsmen expire without passing on their talents, the ability to build jeweled detached lever escapements of suitable quality for military use will be seriously jeopardized.

Senator SYMINGTON. Thank you, Mr. Draper.

You have been in the hearing room all morning?

Mr. DRAPER. I have.

Senator SYMINGTON. You have heard the testimony of General Bradley and Mr. Lazrus?

Mr. DRAPER. I have.

Senator SYMINGTON. This committee is interested in the facts, then making a report on them.

Have you any further comments you would like to make in addition to the statement, as a result of the testimony you heard this morning?

Mr. DRAPER. I would simply add the fact that I really believe the jeweled detached lever escapement is the heart of the timers that I cite, and these perhaps have been about a third of the applications which we have developed and put into stockpile as timers, exclusive of explosive timers. Here we are still pressing the state of the art. And one of the timers which the Hamilton Watch Co. has here today is still seeking to extend its capability in response to a military desire for a longer period of time. And the method of meeting that is going to be solved, I think, in the escapement, and by pressing the stage of development at that point.

We are presently engaged with the Hamilton Watch Co. on a research contract with just that objective in mind.

Senator SYMINGTON. Thank you.

Senator Saltonstall, have you any questions?

Senator SALTONSTALL. Mr. Chairman, I am sorry that I wasn't here more this morning, but I was in the Appropriations Committee meeting.

I would like to ask this one question which, if the chairman feels has been covered, I hope you would tell me.

Has there been any discussion of quotas, or is it entirely a question of tariff?

Senator SYMINGTON. There hasn't been any discussion of quotas, or discussion of a change in tariff. The question has been primarily whether or not it is important to preserve a jeweled watch manufacturing business in the United States from the standpoint of national security.

Senator SALTONSTALL. Thank you, Mr. Chairman.

I would just say I would feel very strongly that it was.

Senator SYMINGTON. Senator Jackson.

Senator JACKSON. No questions.

Senator SYMINGTON. Senator Smith?

Senator SMITH. No questions.

Senator SYMINGTON. Senator Thurmond?

Senator THURMOND. No questions, Mr. Chairman.

Senator JACKSON. I might ask one.

Do you feel that out of this talent in the American watch industry, jeweled-watch industry, that you can continue to look for improvements in the state of the art as long as that talent and know-how is there?

Mr. DRAPER. We feel it is vital to pursuing this method of getting timing components developed.

Senator JACKSON. You know what they have already accomplished. But experience would tell you that with this talent in being in the United States, the opportunity to improve the state of the art is present, it is there?

Mr. DRAPER. I feel it is. And there are certain applications which can be best met by timers employing this kind of escapement.

Senator JACKSON. That is all.

Senator SYMINGTON. Senator Thurmond.

Senator THURMOND. Mr. Draper, I would just like to ask you this question:

If our jeweled-watch industry is allowed to become extinct in the United States, and we suffered the loss of the craftsmen and the skills that have been acquired in that industry, which has been assisting in our national defense, would there be jeopardy to the security of this Nation?

Mr. DRAPER. I believe so in the sense that applications to which we would apply it would be denied us in the future, or we would have to go to more complex or perhaps more vulnerable methods of satisfying the timing components in those systems.

Senator THURMOND. In other words, if I construed properly what you are saying, you feel that it is essential to our national defense that the jeweled-watch industry not be allowed to become extinct.

Mr. DRAPER. I agree.

Senator THURMOND. Thank you very much.

Senator SALTONSTALL. Mr. Chairman, may I ask one more question?

Senator SYMINGTON. Senator Saltonstall.

Senator SALTONSTALL. I have followed this matter for a good many years, particularly in connection with the Waltham Watch and the Hamilton and so on.

Now, when you raised the tariff in 1954, how much did that help the question of employment and jeweled watches in this country. Very little—am I correct?

Senator SYMINGTON. Mr. Draper——

Mr. DRAPER. I am not sure I would be the best source of the answer.

Senator SYMINGTON. If you could hold that question, Senator——

Senator JACKSON. That should be directed to the industry.

Senator SYMINGTON. Thank you very much.

Mr. DRAPER. Thank you.

Senator SYMINGTON. General Bradley, would you attempt to answer the question of Senator Saltonstall.

General BRADLEY. Yes, sir. Senator Saltonstall, I believe the other companies feel the same way I do. It did slow up the death of the watch industry, it helped, but it did not cure it. There are several other things that we think should be done, and we think the Government should find some solution. You asked the question whether or not it should be quotas. We didn't go into that.

We just say some solution must be found by the Government. Therefore several things are involved. One of them is the question of its duty or tariffs, or a combination of both of them. Then there is the question of stopping the loopholes from the Virgin Islands, from which this country imported last year nearly 1,100,000 units duty free, and the question of smuggling.

We think all of those things should be solved by our Government.

Senator SALTONSTALL. General Bradley, if this industry is vital to the security of our country, then these questions of tariffs or quotas or any smuggling and so on is vital to the future.

General BRADLEY. We think it is. We have recommended that the tariff not be lowered. We have recommended that a quota system be established. We have recommended, and even submitted a draft of a law which would stop the import of watches duty free from the Virgin Islands in such quantities. And we have submitted legislation which we think would stop smuggling.

Senator SALTONSTALL. What is the situation now with relation to Mexico?

General BRADLEY. I don't think there is any problem in Mexico I know of.

Senator SALTONSTALL. There was a problem.

General BRADLEY. A lot of the smuggled watches come through Mexico, most of them in fact.

Senator SALTONSTALL. What you are saying, General, to us in this committee—I am sorry I came in so late—what you are saying is, "Do something," but you don't know just what is the best method of accomplishing the result.

General BRADLEY. Yes, sir; I think that. But what we would like for this committee to do—that is what I understood you had in mind was as members of the Armed Services Committee, to determine whether or not you still think, as you did 10 years ago, that this watch industry, both jeweled and nonjeweled, is essential to national defense, national security.

And I think when you get through seeing all the exhibits, and hearing from all these other people, you will be like I am—knowing just what Bulova has done—I was very much concerned that we were going to lose this capability, and what it would do.

Now, after seeing—and I have heard these other people's presentations—after seeing what they are doing, I am really scared, because if all this ability, capability, is wiped out, and we are, at the same time, spending billions of dollars on defense, are we going to lose it all because of a loss of skill of 2,000, 3,000 people, all at the instigation of a neutral country, the Swiss?

Senator SALTONSTALL. You are not asking for subsidies in any way.

General BRADLEY. No, sir; I don't know what the solution is. I don't recommend subsidies, because they are so uncertain. It would be pretty hard to get people to come into the watch industry and learn its skills if they depended each year upon an appropriation for subsidies. That would be the cheapest way probably.

But it would be rather uncertain.

Senator SYMINGTON. If the Senator will yield—as I understand it, all you are asking this morning is for the Armed Services Committee to decide whether or not the jeweled-watch industry is essential, or not essential, to the security of the United States, correct?

General BRADLEY. Yes, sir. And I would include other watches as well as jeweled watches.

Senator SALTONSTALL. Then if the committee answers the question affirmatively that Senator Symington just put, the question is how to maintain the industry, is it not?

General BRADLEY. We think probably the easiest way is by a system of tariffs and quotas. That is the way most countries control it—France, England. Of course Russia excludes all imports. That is hardly a fair example.

Senator SALTONSTALL. We tried to help that way back in 1954.

General BRADLEY. At that time you did not have a quota. You raised the tariff, but there was no quota set up. We have quotas on other things. For example, you have it on textiles. The minute it gets 4 or 5 percent people begin to worry, and you start talking about quotas.

Here we have lost 86 percent and we still don't have a quota.

Senator SALTONSTALL. We have the agony now of quotas in the wool industry.

General BRADLEY. Quotas on many things, but not watches.

Mr. Chairman, there is a man here from NASA who has an appointment somewhere else this afternoon.

Senator SYMINGTON. We will hear him now.

Before we hear him, let me ask you this question.

Do you manufacture watches in Switzerland?

General BRADLEY. Yes, sir. We manufacture all our 17-jewel watches in Switzerland, because we cannot compete with 17-jewel watches, the tariff is not enough. We make only Accutrons and above 17-jewel watches in this country. Some of the other watch companies still make 17-jewel watches here. They can tell you about that when they make their statements.

Senator SYMINGTON. Now, are you the smallest, middle or largest manufacturers in Switzerland?

General BRADLEY. I believe we are the largest manufacturer of jeweled watches in the United States. We are also the largest manufacturers of jeweled watches in Switzerland.

Senator SYMINGTON. Of just American companies, or of all companies?

General BRADLEY. American companies, sir. That includes Swiss companies. We are the largest one as far as I know.

Senator SYMINGTON. You are the largest manufacturer of jeweled watches in Switzerland, regardless?

General BRADLEY. Yes, sir. And we have a more integrated plant than most of them. Many of them are assemblers.

Senator SYMINGTON. Is it fair to say that, if you were only thinking of profits, it would be relatively immaterial as to whether you produced these movements in this country or in Switzerland.

General BRADLEY. We cannot make profit on a 17-jewel watch made in this country. And we only maintain our domestic facilities by manufacturing the other ones where we about break even. I would not want to blow this about too much to our stockholders, of which we have 5,500, but I suspect we would make more profit for them if we imported all of our watches. But I just cannot go along with that for various reasons.

The main one is national defense, and the other is I don't believe the Americans believe in anybody having a monopoly.

Senator SYMINGTON. So is it fair to say that your testimony is in the interests of your country, and possibly at the expense of your profits.

General BRADLEY. We don't like to brag too much about that, Mr. Chairman.

Senator SYMINGTON. If you are the largest manufacturer of watches in Switzerland, and if you make more profit on your Swiss watches because you pay one-third of what you pay workers here, than it would seem you are automatically stating that, although the situation is highly satisfactory to you from the standpoint of profit through the Swiss position, nevertheless you believe in the interests of our national security you should look further than the relatively narrow aspect of the income of your company?

General BRADLEY. That is a primary reason. But I would hate to see us dependent on any one country for any item.

Senator SYMINGTON. General, do you have another witness?

General BRADLEY. If it is all right with you, sir, I would like to call the witness from NASA at this time—Dr. Robert Coates.

Senator SYMINGTON. Dr. Coates.

Doctor, have you a prepared statement?

Dr. COATES. Yes, I do. I have a prepared statement which discusses NASA uses of timing systems in the space programs.

Senator SYMINGTON. Would you like to read it?

Dr. COATES. Yes, I would please.

Senator SYMINGTON. Would you proceed.

STATEMENT OF DR. ROBERT J. COATES, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD SPACE FLIGHT CENTER

Dr. COATES. Mr. Chairman and members of the committee, timing systems are an important link in the chain of a space mission. Accurate and reliable timing is essential to success because time is used in the control of the space mission, in the analysis of the scientific data from the spacecraft, and in the termination of the space mission.

I am sure all of you have witnessed parts of the countdown sequence for the Project Mercury launches. The same procedure is followed for all launches. The countdown clock serves to tie together all of the prelaunch operations into one continuous sequence leading up to the instant of launch.

During the launch phase the first-stage rocket burns for a specified period of time; the rocket coasts for an additional segment of time; the first stage is separated from the second stage and the second-stage rocket fires; the second-stage rocket is cut off after the desired period of burning; and, in some missions, this sequence is repeated for third- and fourth-stage rockets. The precision execution of all of these functions is controlled by timing systems in the launch vehicle and at the ground stations. Other functions such as nose cone ejection, unfolding of spacecraft solar panels, and deployment of radio antennas are started by the timing systems.

Once the spacecraft is in orbit, the spacecraft clock system controls the sequence of performance of the scientific observations. In some of the small satellites the sequences are preprogramed before launch, but in larger, more advanced satellites and space probes the program of observation can be changed by commands sent from the ground stations. Consider the Tiros weather satellite as an example. Tiros is spin stabilized which means that the spin axis, along which the cameras look is fixed in space.

If I use this spool to indicate the earth and my pencil to indicate the axis of the satellite, and also the look angle of the cameras, you can see as the satellite goes around the earth, that in this position the cameras look down on the earth, but as it gets around here it is looking away from the earth.

Thus, as Tiros travels around the earth, its cameras are looking at the earth only half of the time. In addition, the cameras can take usable pictures only when the earth is in sunlight. The Tiros satellite is programed to take pictures only when the cameras and the sun are in the proper positions for good pictures. The time sequence for each orbit is computed at the Tiros control center. The command station sends this sequence to the satellite, and the spacecraft clock follows the sequence, starting and stopping each function at the prescribed time.

By this procedure the Tiros project can program the satellite to take pictures of specific weather features such as hurricanes. A similar type of operation is illustrated by the recent Ranger observations of the moon. The Ranger television cameras were turned on and sequenced by the spacecraft timing system.

The Ranger cameras took 4,316 pictures of the moon and sent these to earth by radio. The time at which each picture was received was recorded with the data at the ground station. The ground station was tracking the spacecraft during the mission and determined the spacecraft position as a function of time.

Thus it was possible to deduce the position of the spacecraft for each picture from the precise knowledge of the times of each picture. This is typical of all data acquisition from satellites and space probes. Accurate time signals are put on every recording of data from NASA spacecraft so that the spacecraft position, spacecraft attitude, solar conditions, and so forth, can be known for every scientific measurement. Data without time has no value because the data requires correlation with the spacecraft position and conditions before useful results can be obtained. The very successful Imp satellite project mapped the earth's magnetic field. Time was necessary to identify the spacecraft position of each observation in order to construct a map of the magnetic field. The Goddard Space Flight Center requires all satellite projects under its management to have a timing system in the spacecraft which inserts timing signals into the data when it is recorded on the spacecraft or transmitted to the ground station. This provides a double check on timing accuracy in order to be sure of correct time for the scientific data.

Another use of a timing system on a spacecraft is to turn off the spacecraft's radio transmitter. It is NASA policy to have a fail-safe timer on each satellite to cut off the radio transmitter at the end of the predicted useful life of the satellite. This is necessary in order to prevent a nonfunctioning satellite from causing radio interference to a new satellite project.

You may be curious about the timing accuracies needed by NASA for accomplishing the functions just described. A satellite in a 260-mile circular orbit will have a speed of about 25,000 feet per second. Thus time must be accurate to 0.001 second in order to determine position to within 25 feet. For the Mariner moon probe, the spacecraft approaching the moon with a speed of approximately 5,000 miles per hour moves about 7 feet in 0.001 second. Each ground station in the NASA satellite tracking and data acquisition network has a precision crystal oscillator time standard which drifts less than 0.001 second in 10 days. These time standards are periodically calibrated with the National Bureau of Standards station WWV time signals so that the time error is less than 0.002 second. The ground station for deep space missions use a rubidium vapor time standard which will drift less than 0.001 second in a year.

These time standards provide time signals for both tracking and data acquisition so that the full precision is available for time identification of the data as well as for tracking.

The spacecraft timing systems used for sequencing the observations usually are not as accurate as the ground station clocks. A spacecraft clock drift of the order of 1 second per day is usually acceptable for controlling a satellite orbit by orbit because the ground station time standard can be used to more accurately calibrate the spacecraft clock and to supply precise time in data acquisition. However, missions like Apollo require two orders of magnitude better stability than most satellites. The spacecraft time systems stability is obtained by using either a tuning fork oscillator or a crystal oscillator, plus electronic counter circuits. The crystal oscillator is capable of giving greater stability than the tuning fork oscillator.

In the case of the timers for cutoff of the spacecraft radio transmitter, the timing accuracy requirement is quite low. The main requirement is for the timer to run for a year without failure, to use very little power, and to be very small and light. The timer has to operate independently of other parts of the spacecraft in order to prevent timer failure due to malfunction of any of the other spacecraft subsystems. Accutron-type cutoff timers have been used on several NASA spacecraft.

In summary, very accurate timing systems are essential parts of all NASA space flights. The time stability requirements cover a very wide range up to 0.001 second per year. Electronic timing systems are universally used in space missions to provide the necessary accuracy, stability, and reliability. It is a tribute to American industry that all the systems discussed here have been domestically designed, fabricated, and tested; a large element in the success of the national space program is provided by our ability to rely upon industry to give us equipment of this quality.

Senator SYMINGTON. Thank you, Doctor.

Senator Saltonstall?

Senator SALTONSTALL. I have no questions.

Senator SYMINGTON. Senator Jackson?

Senator JACKSON. No questions.

Senator SYMINGTON. Senator Thurmond?

Senator THURMOND. As I construe from your statement, Dr. Coates, the watch industry is an essential industry to our national defense?

Dr. COATES. The watch industry has made contributions in the space program in the form of timing systems and also in the form of other mechanical devices, such as latching relays, displays, things of that type.

It is only fair to say they are not the only contributors in the space technology—that it has been the effort of large segments of American industry that have really advanced the technology needed for the space program.

Senator THURMOND. Would you consider it detrimental to our national defense, our national security, if the watch industry became extinct in this country and we had to rely on foreign countries for the parts and equipment that we would need in case of an emergency or war?

Dr. COATES. Well, I would hate to lose the services of any segment of American industry that has demonstrated the development capabilities that are needed in the space program.

As I say, this is fairly widespread. The watch industry has made contributions to the space industry, and thus they fit right into the total picture.

Senator THURMOND. Well, I presume from that, Doctor, that you would consider it detrimental to our national security if we had to depend upon foreign nations to supply this.

Dr. COATES. Yes; I would consider it very detrimental if we had to rely on foreign governments, foreign countries, suppliers, for any phases of our national defense.

Senator THURMOND. Thank you. Thank you, Mr. Chairman.

Senator SYMINGTON. It is now 20 minutes of 1.

General Bradley, we will recess until 2.30 this afternoon.

Senator SALTONSTALL. Mr. Chairman, I have to attend another Appropriations Committee meeting this afternoon. May I ask this one question of General Bradley?

General, is it your opinion, if a great emergency should come, that we would have to rely very considerably on importing on bringing into this country from countries like Switzerland particularly, where watches are made by our companies, as was testified to—will it be essential to bring in much of the equipment for our security from Switzerland and other countries?

General BRADLEY. Well, I don't think you would get it, Senator, if you had to depend on it. For example, in the last war we had to depend—we had been depending on Switzerland for jewel bearings, and there are a lot of jewel bearings in all instrumentation, accurate instruments. And we finally got started over here and made some, and the watch companies were the instigators of that—I covered that in my statement. But we finally had to smuggle jewel bearings out. Now, you could not smuggle much big equipment. Sure, we have some jewel bearings now in the stockpile. But if we had to depend on any foreign country for new equipment of this nature, I just don't think you would get it.

Senator SALTONSTALL. So your point of view is even if our companies—one of our companies is the largest producer of watches in Switzerland today, that we should not rely on that.

General BRADLEY. No, sir, there are several things. You probably could not get it out. And furthermore, when you try to go into a foreign country and work on some of these top secret things you are violating security. We had a recent example about 2 years ago in jewel bearings. There was a certain requirement for a guided missile for special jewel bearings, and they only wanted eight of them. No foreign country was interested in making eight jewel bearings. And it would have taken a long time to get them, anyway.

We made them for this program in the Government plant that we run in North Dakota for the Government—we made these special jewel bearings. The missile worked within a couple of weeks. We like to think we contributed something to the success of it, by the fact that we were prepared to provide these small things.

And it is not only in the case of an emergency. From day to day we like to think we are contributing to the improvement of weapons.

We had one witness we hoped you would be able to hear before noon—I don't know whether he is available this afternoon—Mr. Mosley, from Day & Zimmerman, who had something to do with a weapon used very recently in the Bay of Tonkin, 10 days or so ago. I think it would only take about 5 minutes.

Senator SYMINGTON. If it would take only 5 minutes.

Mr. Mosley, will you identify yourself?

Mr. MOSLEY. I am vice president of Day & Zimmerman, an engineering firm in Philadelphia.

Senator SYMINGTON. Have you a prepared statement?

Mr. MOSLEY. No, sir.

Senator SYMINGTON. Please proceed.

STATEMENT OF WILLIAM MOSLEY, VICE PRESIDENT OF DAY & ZIMMERMAN

Mr. MOSLEY. We, as part of our business, are operators of the Lone Star Army Ammunition Plant in Texarkana, Tex., which is operating on about a 60-percent rate at the present time. One of the major products of that plant, ammunition we load, are fuses.

Now, normally the Army buys fuse parts themselves, furnishes them to us, and we load them with ammunition, with explosives. When there is an emergency program, they come to us and we are required to buy these parts, load them, and make crash shipments on an emergency basis.

Just recently we had occasion to buy a fuse, fuse parts, and the Hamilton Watch Co. furnished the arming and timing device, which is quite a complicated mechanism, in an amazingly short time, and we were able to make an oversea commitment by shipping out just 10 days ago. And this is when we only knew about this thing in late April.

The point I wish to make here is that from a time standpoint, the watch industry in this country, as far as we are concerned, was absolutely vital in meeting this emergency.

And this is a duplication of another situation that happened in 1961.

Incidentally, we were only able to find two companies, one was Bulova, and the other Hamilton, that were able to bid on this item at all within the time frame we were required to meet.

Senator SYMINGTON. That is interesting. Thank you.

Senator Saltonstall.

Senator SALTONSTALL. No questions.
Senator JACKSON. No questions.
Senator THURMOND. No questions.
Senator SYMINGTON. The committee will recess until 2:30.
(Whereupon, at 12:45 p.m., the committee recessed, to reconvene at 2:30 p.m. of the same day.)

AFTERNOON SESSION

Senator SYMINGTON. The hearing will come to order.
General Bradley, you have been calling witnesses to present your side of the case. Who is the next witness?

STATEMENT OF GEN. OMAR BRADLEY—Resumed

General BRADLEY. Thank you very much, Mr. Chairman.
Before we call the next witness, I would like to draw your attention to this fact. We had hoped that there would not be too much emphasis placed in the 1958 ODM hearings, because we never did think it was correct. But since a quotation has been made from the Secretary of Defense in part, I would like to add a little more by quoting a letter, in which the Secretary of Defense said:

> In the course of the study it became apparent that the entire horological industry (the nonjeweled watch and clock producers as well as the jeweled watch manufacturers) was essential to the mobilization base * * *. The Department of Defense does not expect jeweled watches to be the jeweled watch industry's only basis of essentiality. It expects the jeweled watch industry, together with the balance of the horological industry and other capable manufacturers, to the degree that they are able, to continue to design and produce very complex timing mechanisms, control devices, gyroscopes, and similar items which must be miniaturized and ruggedized if they are to be used in modern military equipment.

That complete statement together with a 1958 statement by the Secretary of Defense, is in my prepared statement which was submitted to the committee. (See statement beginning p. —.)
Senator SYMINGTON. As I understand it, this is adding some more sentences to what was brought up this morning by Mr. Lazarus; is that correct?
General BRADLEY. Yes.
As the next witness, we would like to call on Arthur Sinkler, president and chairman of the Hamilton Watch Co.

STATEMENT OF ARTHUR B. SINKLER, PRESIDENT AND CHAIRMAN, HAMILTON WATCH CO.

Mr. SINKLER. Mr. Chairman, my name is Arthur B. Sinkler. I am president and chairman of the board of the Hamilton Watch Co. For this investigation it is more important that I have spent my adult life in learning the watch business, primarily from the manufacturing side.
Senator SYMINGTON. This is your prepared statement?
Mr. SINKLER. It is, sir.
Senator SYMINGTON. And you would like to read it?

Mr. SINKLER. I would, sir.

Senator SYMINGTON. Would you proceed?

Mr. SINKLER. I began in 1936 as a watchmaker in the factory, and after World War II became successively director of quality control, general manager of the defense orders division, director of research, and vice president in charge of manufacturing.

I have prepared a longer statement, Mr. Chairman, which has been filed with the clerk, and I would like to have it attached to this short statement as part of the record, if that meets with your approval.

Senator SYMINGTON. Without objection.

Mr. SINKLER. Based on the many years experience I have had in helping my company help the military services, I want to tell this committee that at no time has the jeweled watch industry been more important to this Nation than it is today. Before 1958 the industry's defense role had been largely to supply timepieces, navigation instruments for aircraft and ships, jewel bearings, and safety and arming devices for bombs, artillery shells, and rockets. Those were then our primary weapons.

Today the industry is designing and making the timing devices for our ultimate weapons—newer shells and rockets and nuclear missiles. The products of the experience and training and knowledge of its 2,500 workers will ride in practically every missile now being produced by the United States and will turn the missile on only after there is no danger of destroying our own men, ships, and planes, and in some cases, destroy the missile itself if it misses its intended target.

Such a product, I will remind you, rode in the weapons which destroyed Communist PT boats in the Gulf of Tonkin within the last few days. The product must be very small, a few ounces in some cases, and yet withstand accelerations and shocks of many times the force of gravity, be impervious to nuclear radiation, and operate precisely through great extremes of heat and cold. And it must not fail.

If there is a question of importance, I suggest the committee determine how many of the great missiles we have distributed at such fabulous cost throughout this country and the world, and upon which we depend in event of nuclear assault are themselves dependent upon devices from our workers to become operational after launching and safe theretofore. Just a few years ago you will recall that a fully operational Bomarc A missile caught fire and burned in its emplacement at McGuire Air Force Base. Hamilton, as sole producer of that missile's safety and arming programer, was glad to learn that the safety operations of this device had prevented a minor accident from becoming a serious nuclear catastrophe. This is but a small example of how important the right kind of workmanship can be.

I would like to place in the record, if the chairman will permit, a copy of a chart of current U.S. missiles, to which Senator Thurmond referred this morning, taken from an Aviation Week publication, published this spring. This chart shows as to each missile whether it is still in the design state, or is in development or production or service use. We have added another missile not included, which was not on the list, the Walleye. In the left-hand margin we have marked with a symbol the missiles on which one or more of the three jeweled watch companies and General Time Corp. is or has been working. The committee will find that the companies are involved in 18 out of 19 of the U.S. missiles now in production. Although we have been unable to identify the 19th, it is quite possible that this, too, may be included, or that it comes from another place in the horological industry.

B = Bulova H = Hamilton
E = Elgin G = General Time

U. S. Missiles

Mission category		Name	Designation	Cognizant service	System manager/prime contractor	STATUS: Research	Development	Production	Service use	AIRFRAME: Assoc. contractor or manufacturer	Max. length, ft.	Max. span, wings or fins, ft.	Body diameter, ft.	Launch weight, lb.
Air-to-air	H	Falcon	AIM-4A	USAF	Hughes	....	....	....	✓	Hughes	6.5	1.7	0.53	120
	H	Falcon	AIM-4C	USAF	Hughes	....	....	....	✓	Hughes	6.5	1.7	0.53	120
	H	Super-Falcon	AIM-4E	USAF	Hughes	....	....	....	✓	Hughes	7.2	2.0	0.55	150
	H	Super-Falcon	AIM-4F	USAF	Hughes	....	....	....	✓	Hughes	6.7	2.0	0.55	145
	H	Falcon	AIM-47A	USAF	Hughes	✓	✓	....	....	Hughes	....	....	....	....
	H	Falcon	AIM-26A	USAF	Hughes	....	....	....	✓	Hughes	7.0	....	0.92	200
	E	Genie	AIR-2A	USAF	Douglas	....	....	....	✓	Douglas	9.0	3.3	1.5	835
		Phoenix	AIM-54A	USN	Hughes	....	✓	....	....	Hughes	....	....	....	....
	BEH	Sidewinder 1A	AIM-9B	USN	Philco	....	....	....	✓	Philco	9.4	....	0.42	155
	BEH	Sidewinder 1C	AIM-9D	USN	Philco	....	✓	✓	....	Philco	9.4	....	0.42	155
	BEH	Sparrow 3a	AIM-7D	USN	Raytheon	....	....	....	✓	Raytheon	12.0	3.3	0.67	400
	BEH	Sparrow 3b	AIM-7E	USN	Raytheon	....	....	✓	✓	Raytheon	12.0	3.3	0.67	400
Air-to-surface	BEG	Bullpup A	AGM-12B	USN	Martin-Maxson	....	....	✓	✓	Martin-Maxson	10.5	3.3	1.0	571
	BEG	Bullpup B	AGM-12C	USN	Martin	....	....	✓	....	Martin	13.6	4.0	1.5	1,785
	BEG	Nuclear Bullpup	AGM-12D	USAF	Martin	....	....	....	✓	Martin	....	3.4	1.1	....
		Condor	AGM-53	Navy	NOTS	✓	....	....	....	....	....	....	....	....
		Hound Dog	AGM-28B	USAF	North American	....	....	✓	✓	NAA	42.5	12.0	2.3	10,000
	E	Quail	ADM-20C	USAF	McDonnell	....	....	....	✓	McDonnell	12.9	5.4	2.5	1,200
	E	Shrike	AGM-45A	USN	NOTS	✓	✓	....	....	....	....	....	....	....
Anti-submarine	B	Asroc	RUR-5A	USN	Minn. Honeywell	....	....	....	✓	Minn. H.-Gen. Mills	15	2.5	1	1,000
	EGH	Subroc	UUM-44A	USN	Goodyear Aerospace	....	✓	✓	....	Goodyear Aerospace	21.0	....	1.75	4,000
Surface-to-air		AADS-70	....	Army	Hughes, Raytheon, RCA	✓	....	....	....	....	....	....	....	....
	H	Bomarc A	CIM-10A	USAF	Boeing	....	....	....	✓	Boeing	47.0	18.2	3.0	15,000
	H	Bomarc B	CIM-10B	USAF	Boeing	....	....	....	✓	Boeing	45.0	18.2	3.0	16,000
	E	Hawk	MIM-23A	Army	Raytheon	....	....	✓	✓	Northrop	16.5	4.0	1.2	1,295
	GH	Mauler	XMIM-46A	Army	GD/Pomona	✓	....	....	....	GD/Pomona	6	....	0.42	120
	EH	Nike Ajax	MIM-3A	Army	Western Electric	....	....	....	✓	Douglas	21.0	4.5	1.0	1,300
	EH	Nike Hercules	MIM-14A	Army	Western Electric	....	....	....	✓	Douglas	41	7.5	2.6	10,000
	EH	Nike X/Zeus	XLIM-49A	Army	Western Electric	✓	✓	....	....	Douglas	48	3.8	6.7	....
	E	Nike X/Sprint	....	Army	Western Electric	✓	....	....	....	Martin/Orlando	....	....	....	....
		Redeye	XMIM-43A	Army	GD/Pomona	....	✓	....	....	GD/Pomona	4.0	0.25	0.25	28
	BE	Talos	RIM-8E	USN	Bendix	....	....	✓	✓	McDonnell	19.0	5.5	2.5	3,000
	BEH	Tartar	RIM-24B	USN	GD/Pomona	....	....	✓	✓	GD/Pomona	15.0	1.7	1.1	1,425
	BEH	Terrier	RIM-2E	USN	GD/Pomona	....	....	✓	✓	GD/Pomona	27.0	1.7	1.0	3,000
Surface-to-surface Strategic and tactical	H	Atlas D	CGM-16D	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	265,000
	H	Atlas E	CGM-16E	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	270,000
	H	Atlas F	HGM-16F	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	269,000
		Mace A	MGM-13B	USAF	Martin	....	....	....	✓	Martin	44.0	22.9	4.5	14,000
		Mace B	CGM-13C	USAF	Martin	....	....	....	✓	Martin	44.0	22.9	4.5	14,000
	BH	Minuteman	LGM-30A	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	✓	✓	Boeing	53.7	....	6	65,000
	BH	Minuteman	LGM-30B	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	✓	✓	✓	Boeing	55.9	....	6	65,000
	BH	Minuteman	LGM-30F	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	✓	✓	....	Boeing	59.8	....	6	65,000
		MMRBM	....	USAF	Hughes[1], AFSC/BSD	✓	✓	....	....	....	....	....	....	....
	BEH	Polaris A1	UGM-27A	USN	Lockheed	....	....	✓	✓	Lockheed MSC	28.0	....	4.5	28,000
	BEH	Polaris A2	UGM-27B	USN	Lockheed	....	....	✓	✓	Lockheed MSC	31.0	....	4.5	30,000
	BEH	Polaris A3	UGM-27C	USN	Lockheed	....	✓	....	....	Lockheed MSC	31.7	....	4.5	30,000
		Taurus	ZRGM-59A	USN	....	✓	....	....	....	....	....	....	....	....
	G	Titan 1	HGM-25A	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	Martin/Denver	98.0	....	10.0	220,000
	G	Titan 2	LGM-25C	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	✓	✓	Martin/Denver	103.0	....	10.0	330,000
Battlefield support—guided missiles		Corporal	MGM-5A	Army	Firestone-Gilfillan	....	....	....	✓	Firestone-Gilfillan	45.0	6.7	3.0	11,247
	H	Lacrosse	MGM-18A	Army	Martin	....	....	....	✓	Martin	19.2	9.0	1.7	2,300
		Lance	XMGM-52A	Army	Ling-Temco-Vought	✓	✓	....	....	LTV	....	....	....	....
	B	Pershing	MGM-31A	Army	Martin/Orlando	....	....	✓	✓	Martin	34.6	....	3.3	10,000
	H	Redstone	PGM-11A	Army	Chrysler	....	....	....	✓	Chrysler	69.0	9.5	6.0	61,700
		Sergeant	MGM-29A	Army	Sperry/Utah	....	....	....	✓	Sperry/Utah	34.5	....	2.6	10,000
	BE	Shillelagh	MGM-51A	Army	Philco/Aeronutronic	....	✓	....	....	Philco/Aeronutronic	....	....	....	....
		TOW	....	Army	Hughes	....	✓	....	....	....	....	....	....	....
Battlefield support—unguided missiles	H	Honest John	MGR-1	Army	Emerson-Douglas	....	....	✓	✓	Emerson-Douglas	25.0	4.5	2.5	....
	H	Little John	MGR-3A	Army	Emerson	....	....	✓	✓	Emerson	15.0	2.0	1.4	776

ABBREVIATIONS: AFSC—Air Force Systems Command; BSD—Ballistic Systems Division; GD—General Dynamics; GE—General Electric; GM—General Motors; lpr.—liquid-propellant rocket; LTV—Ling-Temco-Vought; MIT—Mass. Inst. of Technology; MSC—Lockheed Missiles and Space Co.; NAA—North American Aviation

G=Walleye

It is a cold, stark, hard fact that our missile system is controlled by timing devices derived from the skill of very few men, for in each of these four companies, there are key engineers and tool and die makers with a lifetime of training in timing devices without which the companies themselves could not produce.

The reason for this concentration is very simple. The watch companies can do the best job in the shortest time in this field because that has been their business for many decades—for a century, in the case of one company. The U.S. watch companies are the most advanced organizations in the world in the field of miniature mechanical time keeping.

Again and again for many specific weapons, we have performed where others failed, or took too long, or produced with less reliability. But because others eventually learned how, often with our technical help, those who regard this problem as conflicting with our trade program say the industry is not "unique," or not "essential." I disagree. But not because of the semantics. I disagree because such words are used to persuade those responsible for our safety to sacrifice the Nation's watch industry to a predatory foreign watch cartel recently adjudicated as being an illegal cartel by the Federal district court in New York.

I shall quote just one sentence, if I may, from the findings of that court, when it said at the end of its opinion that the various illegal activities of the defendant "obviously had a crippling effect in this country and were so intended."

Senator SYMINGTON. Excuse me, crippling effect? What was being referred to?

Mr. SINKLER. It is pretty hard for me to define what the judge meant when he said that, except that trade was being depressed because of the intensified competition from the cartel members against the U.S. industry, and, therefore, crippled it to the extent that Waltham finally had to close its doors and others who have been in the watch manufacturing business had to drop it, because in the jeweled-lever field that we operate in now, there are only three companies left.

Senator SYMINGTON. Your testimony now is that the reference by the judge to "crippling" meant further reduction of production in this country in the watch business, is that right?

Mr. SINKLER. That is the way I would interpret it; yes, sir.

This cartel does not need the business and should not force our services and the people of this country to settle for timing devices which must of necessity come from less experienced and less proven sources. I offer for the record, the testimony of the naval officer who was responsible for satisfying the demand for proximity fuses which arose overnight when the Communists broke across the Yalu River. One has only to read this record to realize that reliance on other industries would be a disservice to the country. I quote only one sentence.

> Had we not had the watch industry to fall back on, we would have had to have fought this war without or with only token quantities of this critical item.

I am quite sure that the Congress did not intend in enacting the Trade Expansion Act, that it should be so applied that our servicemen should fight anywhere, in any engagement, with less than the best weapons we could give them. If I am right, then some action is needed, for watchmaking skills in this country are economically in great peril.

Now, that is the end of my brief prepared statement, Mr. Chairman.

(The complete statement of Mr. Sinkler follows:)

STATEMENT OF ARTHUR B. SINKLER

My name is Arthur B. Sinkler. I am president of the Hamilton Watch Co., Lancaster, Pa. In 1936, shortly after graduating from the University of Pennsylvania, I went to work for Hamilton as a trainee in the watch assembly department. Thereafter, I became successively a position adjustor, department foreman, director of quality control, general manager of the defense orders division, director of research, vice president in charge of manufacturing, executive vice president and, in 1954, president of the company.

It was also in 1954 that I had the privilege of appearing before this committee to testify as to some of the contributions the watch industry, and Hamilton in particular, had made and were making to the national defense. Those hearings were the culmination of the investigation by the committee into the defense essentiality of the domestic horological industry. The committee's conclusion, contained in a single brief paragraph at the end of its report, was as follows:

"It is axiomatic that in time of national emergency, all components of our industrial machine are essential to the country's defense. American watch and clock makers, however, are peculiarly essential, not only in periods of crisis but, in the considered judgment of the subcommittee, in peacetime as well. Their availability in wartime depends upon a continuous peacetime existence at an operating level which utilizes, to the fullest extent possible, the unique, indispensable skills which the horological industry possesses."

Events of the past 10 years have done nothing to challenge the soundness of that conclusion. This is not to say that there have not been changes in the watch industry's defense role since 1954. There have been changes—significant ones. Indeed, and as I hope to demonstrate, developments during the past decade have, if anything, given the committee's earlier conclusion a renewed and strengthened validity.

But before discussing some of those changes, I would like to touch very briefly upon some of the changes that have occurred in the industry as a whole since we last appeared before you.

1. The Waltham Watch Co., has ceased all production in the United States. The New Haven Clock & Watch Co., formerly a producer of pin-lever watches, went out of business in 1959. The E. Ingraham Co., abandoned the production of wrist watches in 1959. General Time Corp., has recently terminated production of parts for wristwatches. U.S. Time Corp., began to import movement parts in 1955 and has continued to import an increasing proportion (over 50 percent) for assembly with domestically produced parts in the United States. A new company, Precision Time Corp., began producing watches from imported and domestic parts in 1958, but closed operations in 1963. Elgin closed its Lincoln, Nebr., plant in 1958, and is currently closing out production at Elgin, Ill., as it phases into limited production of a single ladies' movement at a new plant located in South Carolina. It has recently begun—after a century of production in this country—to close out all U.S. production of men's movements. At the present time, domestic production of watch movements from substantially all domestically produced parts is limited to the pin-lever pocket watch production of the E. Ingraham Co., and General Time Corp., and the jeweled-lever movement production of the Bulova Watch Co., Elgin National Watch Co., and Hamilton Watch Co. These surviving domestic manufacturers have increased their importation of foreign movements, many of which now come from their own affiliates in foreign countries.

2. Domestic production of jeweled-lever watch movements has fallen from 2.4 million in 1953 and 1.7 million in 1954 to just under 1.5 million (including now defunct Precision Time) in 1963. Domestic production of all watches has declined from 8.4 million in 1953 and 7.4 million in 1954 to 3.6 million in 1963. At the same time, imports of watch movements in this country have risen from 10.5 million in 1954 to 14.5 million in 1963. Domestic production accounted for 44 percent of sales on the U.S. market in 1954. Today, that figure is 14 percent.

3. Almost all of the imports I have referred to came from Switzerland. A few weeks after your committee held its hearings in 1954, the Justice Department

filed a civil antitrust suit against the Swiss watch cartel. In filing the suit, the Attorney General announced that the complaint "attacks restrictive controls upon the American jeweled-watch industry which have retarded the growth of the industry and weakened its competitive position." The district court, after elaborate pretrial discovery and a lengthy trial, finally rendered its opinion in December 1962, finding violations of both the Sherman and Wilson Tariff Acts. Its 247 numbered findings of fact trace in detail the oppressive efforts of the Swiss cartel in this country. It found, among other things, that "the purpose of the collective convention (the basic cartel agreement) was to protect, develop, and stabilize the Swiss watch industry and to impede the growth of competitive watch industries outside Switzerland." Noting that "the U.S. watch industry was the Swiss watch industry's biggest competitor," the court stated, at the end of its opinion, that the various illegal activities of defendants "obviously had a crippling effect in this country, and were so intended."

Meanwhile, the number of workers employed in the production of jeweled watches in the United States has declined from 5,951 in 1953 to 2,684 in 1963. It is this precipitous drop in the number of watchmaking employees that, from a national defense standpoint, is of principal concern. For as the committee so appropriately noted in its 1955 report:

Generations of research, development, and production have produced know-how and skills peculiar to the horological industry. Horology has become a unique science requiring specially trained and highly skilled personnel in engineering, toolmaking, poising, and other technical aspects of design and production. It has no counterpart in modern industry. This background, coupled with a capacity for volume manufacturing, permits the watch- and clockmaker to convert almost immediately when time is of the essence * * *. Apart from their unique capabilities, the nature of the watchmakers' skills distinguishes them from other manufacturers. The extraordinary dexterity and the almost unbelievable accuracy required of watchmakers will soon be lost unless the skills are exercised on a continual basis. Thus, the "mothballing" approach can have no application to watchmaking. The skills, which deteriorate with disuse, cannot be stockpiled. They can be preserved only in a going industry.

There have been, as I have suggested and as I am sure you are well aware, major changes in recent years in our weapons systems and the resulting procurements. Many of these changes have been reflected in the nature of defense orders received by the watch industry. As I reviewed the 1954 hearings, I was impressed by the amount of attention given by witnesses from both within and without the industry to the industry's proven capability as a volume producer of fuzes and fuze parts. Members of the watch industry are still producing these items, and have substantial M-Day orders for their production. And while we did testify in 1954 of important work we were doing in designing and developing new ordnance components for the armed services, that type of assignment, it develops, was then but in its incipiency. Insofar as Hamilton is concerned—and I believe this is true for the other watch companies—the most significant change in defense work that has occurred in the past decade has been a dramatic shift away from the high-volume production of a fairly limited category of fuzes and fuze-type devices to involvement in a far broader range of projects in the research, design, development, prototype, and limited production areas.

The trend has been unmistakably toward the development of more complex, relatively sophisticated weapons and weapons systems. Emphasis is being placed more and more upon the miniaturization and reliability of components. These twin goals, of course, are the strong suits of the watch industry whose day-to-day task is to design, engineer, tool for and mass produce tiny parts and miniature, complex mechanisms to extremely close tolerances. This committee predicted 10 years ago that "With rapidly advancing technological developments and with the increasing trend toward more precision, greater miniaturization and increased automation, the skills and facilities of this industry will become increasingly important and vital to the national welfare. This prediction has been fully borne out.

By way of illustration, at Hamilton's plant in Lancaster, we have within the past few years:

1. Designed and developed a family of hardened timers which are employed in the "logic package" of the Minuteman to program events on recovery missions of reentry vehicles. These particular timers employ a high-beat escapement that has been made rugged enough to survive nuclear environments and insure timing accuracy both during and after ocean impact.

2. After three nonwatch companies had tried unsuccessfully to develop and produce an acceptable safety and arming device for the Navy's 5-inch Zuni rocket, Hamilton was awarded a contract by the Diamond Ordnance Fuze Laboratories (now known as the Harry Diamond Laboratories) to completely redesign this unit. In doing so, Hamilton developed a new escapement (which incidentally, we have produced and sold to another company for use in the S. & A. mechanism for the NIKE) and built the tools necessary to make interchangeable parts. As a result of follow-on contracts, we have delivered to date over 10,000 of these units, for which we have been sole source. Hamilton also has developed and produced a flare fuze for the Zuni which, at a preset time after thrust, initiates a black powder charge which in turn ignites a flare and provides target illumination for following attack aircraft.

3. A variation of this device was adapted by Hamilton for use in conjunction with a Hamilton designed escapement timer in the Army's M–55 5-inch bombardment rocket. The S. & A. device, after sensing acceleration, initiates the 90-second timer and lines up the explosive train. The timer releases a firing pin after a preset delay, and the pin, in turn, initiates a thermal power supply. This delayed arming device achieves the safety factor deemed so critical in this weapon.

4. Hamilton, using this same basic S. & A. concept, has also designed, developed, and produced an acceleration-activated timer for use in the Atlas I recovery system. This particular timer, contained in the nose cone of the Atlas, releases at spaced intervals beacon-dye packages which send out signals and emit a dye to assist in locating the missile in the ocean. Hamilton engineers, by noting that the reentry characteristics of the Atlas were similar to the acceleration characteristics of the Zuni, were able to modify the latter's S. & A. device for the Atlas application—at a considerable savings in time and expense to the prime contractor and the Government.

5. Designed and developed the safety and arming programer for the Bomarc A. In addition to keeping the missile fuze and warhead unarmed a safe distance from launch and performing additional switching and arming operations in flight on signals received from the missile's computer and sensing elements, the programer transmits telemetering stage data to external installations. The heart of this unit is a Junghans escapement into which has been built a number of state-of-the-art advances.

6. Hamilton's success with the Bomarc A led to the company's being asked to design, develop, and manufacture the programer for the Bomarc B. The latter device, employing a completely new concept, is used to program a nuclear warhead from safe condition to a state of armed readiness. As might be expected, specifications for this device are exceedingly demanding. I do not believe they could have been met—at least within any realistic period of time—by any company outside the watch industry. Hamilton has been the sole source of these programers for both the Bomarc A and B.

7. Originally designed and developed for Picatinny Arsenal a special switching timer, settable in 5-minute increments from 5 to 30 minutes, for use in a highly classified program. Based on a commercial watch movement with a specially designed escapement and rotary switch, Hamilton is the only company to have made this timer and to date has produced over 1,200 of them. The stringent timing accuracy requirements for this item (for example, it must maintain prescribed timing tolerance over a −65° F. through +160° F. range), indicate that only a watch company could have been awarded these contracts.

8. Earlier this year, Hamilton was awarded a contract to design, develop, and manufacture the retard sensing device for use in the Snakeeye I Weapons System. The device is intended to insure delayed arming of bombs when they are dropped from high altitude aircraft so as to protect the plane and pilot, but through its sensing mechanism to permit immediate arming when fired from planes coming in fast and low in tactics such as those encountered in guerrilla-type warfare. The device will employ a runaway escapement. This is a hot item. Hamilton was chosen for the job because of its experience in producing high quantities of this type of escapement, quickly and at a relatively low cost.

9. Designed, developed, and produced the safety and arming programer for the Redstone missile. This was the first of the programer-type S. & A. devices, a completely new device that begins the evolution from mechanical fuzing such as has been long employed in mortars and other projectiles to the more sophisticated electromechanical and electronic fuzing of today. This particular programer utilizes 2 solenoids, 2 Junghans-type escapements, 2 accelerometers,

1 decelerometer, 5 safety latches, 15 switches, a telemetry network and associated cams, precision gears, etc., to program, launch, boost, fuel, cut off, guide, warhead destruct and warhead detonate signals. It provides 5 timing, 4 g-sensing, and 20 switching functions along the Redstone trajectory. Only Hamilton has made this programer.

10. Hamilton was asked earlier this year to design and fabricate two different timers for other defense contractors. The first, for Motorola, is for a classified end use unknown to Hamilton. A 1-percent timing tolerance had to be maintained while programing a potentiometer-switching device that included eight switches and four multivalue potentiometers. Since no electrical power was available, the unit has to be driven mechanically and can occupy no more than 4½ cubic inches. Manual reset, rewind, and electrical initiation were added requirements. The unique problem area in this particular project was available time. Because of the high classification and priority placed on this device, a total of 4 days was allowed for preliminary design with only 8 weeks for the delivery of three working, field test items. Only tried and proven components could possibly be utilized in a time schedule this tight. Only an experienced watch company could supply the timing heart, make the necessary modifications, and produce a workable end item in this period with any assurance of success.

11. The other timers, for Minneapolis-Honeywell, are intended for use in a classified missile system. As with the Motorola contract, the outstanding requirement of this contract was the short time allowed (60 days) for the completion of 18 units. Hamilton was able to meet this requirement by drawing upon its wide experience in the design of timing devices to select and adapt the most satisfactory escapement and by drawing from its inventory, maintained for just such contingencies, many of the necessary parts.

12. During the Korean war, Hamilton produced over 5 million MK–15 safety and arming devices for use in proximity fuses on Navy 3-inch projectiles. During that period, it contributed a number of design improvements and was advised by letter from the Navy that its performance had been exceeded by no other contractor in the delivery of these devices on schedule and in top quality. In 1958, Hamilton noted that there were many other potential applications for the rugged high beat escapement employed in the MK–15 and, by adding various strength main springs and different gear ratios, the company has redesigned and sold thousands of these units for use in other weapons—for example, to Frankford Arsenal, Minneapolis-Honeywell and Fairchild Camera & Instrument Co. for the Honest John rocket and to Globe Industries for use in a classified bombing system on the B–58A Hustler. A special version of this escapement was designed in 1962 for Lockheed Electronics under a crash program to develop a controller that serves as the intelligence heart of the Polaris reentry vehicle.

13. Hamilton is presently manufacturing a dual channel, escapement regulated 12-hour timer for Sandia Corp. for inclusion as an integral part of a highly classified weapons system. Design and development work on this timer were commenced at Hamilton in 1960. The efficiency and reliability requirements, within wide operational and environmental extremes, demanded several state-of-the-art advances. Tolerances in many places exceed those for the finest watch parts. It is, in fact, one of the most precise mechanisms we have made. I can say categorically that this item could not be produced outside the watch industry within any reasonable cost or time parameters. Some 100 of these Sandia timers have been produced to date. Theoretical and experimental design on the timer has been a continuing assignment at Hamilton. As recently as May, we were given a new R. & D. contract from Sandia to refine, extend the useful running time and, if possible, further improve the timekeeping accuracy of this item.

14. The Army has been working on a new concept of antipersonnel mine which would allow the infantryman to carry and deploy his own protective mine field—i.e., he would carry these small, lightweight mines on his person, emplace them near his position and set them automatically to sterilize at a time determined by him so that unless they had been detonated he could retrieve and reuse them over and over. Another company (outside the watch industry) was awarded the original contract to develop this mine, but was unable to produce a design acceptable for field testing. Hamilton, working with engineers from Picatinny Arsenal, redesigned and built approximately 150 units. Field tests were not completely successful, although they clearly established the feasibility of the concept. Using its own funds, Hamilton has redesigned this mine and successful demonstrations of the new version have been made at Picatinny and Fort Belvoir. The company expects that the program will be reinstituted when funds become available.

15. Hamilton originally designed and has produced a number of different demolition firing devices for both the Navy and the Corps of Engineers using a variety of long delay, timing-triggering devices. These units weigh as little as 4 ounces, can be set to fire at intervals up to 168 hours, can resist an impact of 3,500 gravity (the equivalent of an automobile striking a rigid object at a speed of about 200 miles per hour), will operate with accuracy over a temperature range of —65° F. to 160° F. and at depths up to 100 feet. Many of them have minimum reliability requirements of 1 part in 15,000, the order of accuracy of a fine jeweled watch. One version of these fuses, made on Sandia specifications, has been produced for the Atomic Munitions Branch of Picatinny Arsenal. The timing element of this device was developed from the ground up at Hamilton. The very tight timing tolerances and range of delay intervals required a complete knowledge of escapements and particularly the problems growing out of triggering functions, backlash, and setting mechanisms.

16. Hamilton has also designed and dveloped the MK–23 underwater demolition timer from a set of operational characteristics supplied by the Naval Ordnance Lab at White Oak. Because of the very stringent operating requirements for this timer—particularly with respect to timing tolerances—we feel that it could not practicably be produced by other than a watch company. To date, we have produced several hundred of these underwater delay timers for the Navy.

17. Within the last couple of years, Hamilton has adapted its basic electric-watch movement to an interesting new Navy use. A device has long been needed in underwater mines which would replace the explosive and automatically record the exact time the mine would have been actuated by a passing ship—for use in war games, naval maneuvers, and for the plotting of potential minefields. The electric watch, substantially modified and ruggedized to withstand ocean impact from airdrop and submersion to depths up to 200 feet, was a natural for this application. We are the sole available supplier of this Mark 17 underwater fire recorder and have produced over 1,000 units to date.

The foregoing summaries will serve, I hope, to give some indication of the type of recent contributions, particularly in the realm of research, design, and development, that our company has made to the defense effort. I would like to emphasize that this is by no means an all-inclusive list. I might have mentioned, for example, the special half-second timers we developed and produced for Bell Laboratories for testing on the Nike-Hercules and Zeus, the pressure-sensing switches, or depth compensators we developed and made for Burroughs for use in the Subroc system, or a number of other precision devices and mechanisms we have worked on for various military applications.

Those projects I have discussed, however, have in common the fact that in order to solve the particular problem at hand, we were able to draw upon a vast background of knowledge and skills acquired through years of exposure to similar problems in working with watches and related timing mechanisms. The engineering theory and techniques involved and the machines and people that produced the necessary dies, parts, and models are in each case the same as or similar to the theories, techniques, machines, and skills employed on our basic commercial product.

In many cases, a particularly difficult problem was surmounted or a design or device made more reliable, accurate, or economical through bringing to bear some method peculiar to watchmaking. The Minuteman timers, for example, each use two 25-turn, 138-inch springs in parallel, the design of which was tremendously facilitated by our knowledge of mainspring materials and the production of which was made possible by our miniature rolling and precision metal-strip processing facilities. Our success with the Zuni is in part attributable to having perfected a dip-centrifuge method for lubricating the parts and increasing reliability by heat treating the safety latch to insure a high inside-surface finish—techniques we employ on certain of our watch parts. The Sandia timers involved, among other things, the selection of special alloys, the development of a special lubricant, the redesign of existing partsmaking machinery. A critical component of the Bomarc B programer is a tiny switch. We wrote to over 200 switch manufacturers in an effort to subcontract this item. None would consider making it in the alloted time so we designed and made it ourselves—after testing over 40 combinations of material and subjecting parts to a watch-parts tumbling process in order to obtain the necessary controlled surfaces. A method we devised for chemically treating jewel bearings to retard oil spreading and enhance oil retention was employed on the bearings of the XM–4 timer, the MK 23 underwater demolition device, and the Minuteman timers—in each instance to improve performance characteristics.

Many of the byproducts of our watchmaking, in fact, have found interesting new military applications. Our Lancaster plant, for example, houses a miniature, highly specialized, and completely integrated metals laboratory and mill. Facilities exist for the melting and pouring, forging, swaging, hot and cold rolling, annealing, finishing, slitting, drawing, straightening, and heat treating of a wide variety of metal and alloys. They were developed out of necessity to custom produce and process the small quantities of precise alloys which go into the making of a fine watch. The demand on these specialized metallurgical facilities by outside contractors has been evergrowing. We have been making fine stainless steel wire and strip containing varying quantities of atomic boron for Knolls Atomic Laboratories; .0015 inch thick hafnium (to our knowledge, the thinnest this metal has been successfully rolled) for Knolls; Havar foil as fine as .00009 inch (a human hair is 45 times this thickness) for cyclatron chambers, and Havar .002 inch blades for IBM for saws used to cut tiny silicon transistors and diodes—Havar, I should add, is a corrosion-resistant high-strength cobalt alloy developed by Hamilton for its unbreakable watch mainsprings; special brazing alloys purchased by North American, Chance Vought, and others, for use in aircraft honeycomb structures; low-carbon stainless steel for Pratt & Whitney rocket-motor bellows; .0005 inch zirconium foil for Hercules Powder for use in a solid-fuel propellant; etc. Hercules, incidentally, has told us that this foil is obtainable only from Hamilton and two other sources located behind the Iron Curtain.

Similarly, knowledge we have gained from development of the world's first electric watch resulted in our establishment as a commercial supplier of platinum-cobalt permanent magnets which have a unique capability of providing maximum flux from a minimum volume of magnet material. We have produced and sold these magnets in increasing quantities to other contractors (e.g., RCA, Hughes, Sperry) for use in miniature relays, gyros, traveling-wave tubes, etc., which, in turn, are being employed by those customers in Projects Relay, Syncom, and Mariner (Venus), in the Polaris missile and in the Apollo spacecraft. The company's growing reputation in the field of magnetic-core phenomena contributed, along with its prior experience with the production of mechanical intervalometers, to the receipt by the company last year of a major R. & D. contract from the Bureau of Naval Weapons to design and develop a new "universal" electronic intervalometer which will be usable for the sequence or ripple firing of 2.75- and 5-inch rockets from all Navy aircraft.

I realize that my statement has dealt mainly with development-type projects at Hamilton. This, of course, was purposeful because this is an area in which we have been making an increasingly important effort. I do not mean to minimize, by this, our continuing role as a producer of timepieces for the military, as a volume producer of fuzes, arming devices, and other ordnance items for the services, or as a supplier of precision parts and components for other companies which employ them in other items having a military end-use.

Along with the other watch companies, we are still the only domestic production source for a variety of timekeeping instruments—marine chronometers, elapsed-time clocks, master navigation watches, aircraft clocks, wrist chronographs, hack and other wrist watches and the like. Military orders for these timepieces have dwindled in recent years and many of them, notably aircraft clocks, have been procured by the services from importers. Mobilization orders at Hamilton alone, however, call for the production of thousands of these various types of service timepieces.

With respect to production of fuses and similar ordnanace components, last year we turned out over a half-million escapement and gear assemblies for the Blue III bomb fuse. Our ability quickly to convert to mass production of this sort of mechanism was demonstrated as recently as a few months ago. The Army had an urgent need for XM–423 safety and arming devices for 2.75-inch rocket fuses to be launched by helicopters in limited warfare activities. Hamilton was given a contract on May 7 to produce 58,000 of these devices, increased to 172,000 on May 28. The contract called for delivery of 5,000 units by July 10, approximately 8 weeks after the initial order, and 32,000 units a month thereafter through December. Hamilton was advised by the Army Ammunition Procurement and Supply Agency that Hamilton projects for Sandia and the Harry Diamond Laboratory could be subjected to a 2-week delay if necessary to meet XM–423 schedules. We have been able to meet these seemingly impossible delivery schedules, despite having to design and manufacture tooling for the 42 pieces comprising the device within 8 weeks, by massing our full resources and by drawing heavily upon our prior experience in escapements and particularly in producing the S. & A. device for the Sidewinder missile which the XM–423 resembles.

Finally, I referred to our precision parts manufacture for other defense contractors. A partial listing of these for the past 5 years would include thousands of movement assemblies for Minneapolis-Honeywell and Fairchild for use in the Honest John; over a million pistons, pins, cylinders, etc., for Atlas Powder for use in an explosive switch; and several thousand gears, shafts, pinions, etc., for Kollsman and the Eclipse-Pioneer Division of Bendix for use in aircraft instruments.

Does all of this work we have done qualify us as "essential" to the Nation's defense? I suppose that in the strict sense of the word no one firm or any single industry can lay claim to that label. I will even concede that the most precise, sophisticated, complex item we are capable of making could, if time and money were no obstacle, be made by others outside our industry. But I do say that watch workers are a special breed and that watchmaking is a unique sort of business. The men that work in our plants—be they engineers, tool and die makers, adjusters, screw machine setup men or operators—have for the most part spent their adult lives working with these miniature parts and solving the varied problems connected with them. They know the tricks. They have the skills. And what's most important, this collection of talent and experience exists as a going concern under one roof. It is available when needed and has demonstrated many times that it can make a great number of badly needed military items quicker and better than other possible sources.

Mr. SINKLER. If I may, I would like to present for the record three telegrams which we have recently received which deal with what we have been able to do when there is no other source. They are short, and if I may, I shall read two of them and put them in.

This, I think, is interesting because it arises from an activity in what we call our metals processing, the precision metals division. In this division we set up complete melting, rolling, forging, and processing facilities for making mainsprings and hairsprings, which we could not buy commercially elsewhere. This has grown into a highly specialized commercial business, which produces items which, a few years ago, we never thought we would be able to produce. The first of these telegrams is from the X-Ray Division of the General Electric Co., and reads:

Thank you for your willingness to accept the special rolling order so critically needed by the X-ray department. Your operation remains as the only accepted source for our special requirements of aluminum filter stock furnished free of pits, scratches, and blemishes, as well as held to close thickness tolerances. We have diligently attempted to obtain an alternate source for backup purpose over the past 12 months with no success to date.

That is signed by J. T. LaRocco, of the General Electric X-Ray Division.

The second one is from the Vertol Division of the Boeing Aircraft Co., and reads:

Presently, Hamilton Watch is the only known producer who has been able to consistently meet with tolerance requirements on stainless steel strip required for rotor blade fabrication on the CH–46 and CH–47 helicopters furnished by the Vertol Division of Boeing to the U.S. Government for use by the U.S. Marines and U.S. Army.

That is signed by C. E. Wells, of the Vertol Division.

They are interesting to me because of a little known adjunct of the watch industry, which is our ability to make hairsprings, which has grown into a very important, and, as far as we are able to determine, a unique production for these purposes.

The other one which we recently received was from the West Bend Co.——

Senator SYMINGTON. Is this your third telegram?

Mr. SINKLER. Third, right.

Senator SYMINGTON. You said two. Now you wish to put a third in?

Mr. SINKLER. I said two, and this is the third, right. This will be entered in its entirety. I shall read only one paragraph from it:

We have found through experience that our most reliable source of supply for these items, considering many factors including cost, delivery, and quality, has been, and still is, the American watch and clock industry. As a result of this experience, it is our opinion that this industry fulfills an essential and important role in the defense industry.

(The complete telegram follows:)

AUGUST 14, 1964.

HAMILTON WATCH CO.,
Hartford, Wis.
(Attention Mr. A. B. Sinkler).

In reply to your recent inquiry regarding the importance of the watch industry to the national defense activities, we wish to make the following statements:

The West Bend Co. has been a supplier of military hardware for 12 years. During this period of time we have found it necessary to subcontract the purchase of certain precision items including timers, escapements and escapement subassemblies, as well as volume quantities of gears, pinions, racks, levers, etc.

We have found through experience that our most reliable source of supply for these items, considering many factors including cost, delivery, and quality, has been, and still is, the American watch and clock industry. As a result of this experience, it is our opinion that this industry fulfills an essential and important role in the defense industry.

An excellent example is West Bend's recent production of the BLU/3 bomb fuse. Large quantities of escapement assemblies were required to fulfill this requirement and West Bend found these available from the American watch and clock industry. Had this industry been unavailable to us, we would not have known where to obtain such components and assemblies within the cost and time requirements.

Again, the American watch and clock industry proved its value and essentiality to the defense industry.

E. J. KARCHESKI.

Mr. SINKLER. That, Mr. Chairman, is all I have to say. If you want to pause for questions to me, that will be fine. Otherwise, I want to introduce two of our technical people from two of the companies to show you a few of the items we have been talking about so that this committee will have an idea, visually, of the problems involved.

Senator SYMINGTON. Senator Thurmond, do you have any questions?

Senator THURMOND. Thank you, Mr. Chairman.

Mr. Sinkler, could you give me the figure on watch movements produced in several of the leading countries and then give us the figure produced in the United States?

Mr. SINKLER. Senator Thurmond, I can do it. I would not want to quote from memory. If I may correct the record——

Senator THURMOND. The figures I have here—I want to see if you verify these. Switzerland produces a total of 46 million watch movements annually; 35 million of these are jeweled movements. Do you have any figures there that you could give?

Senator SYMINGTON. If I may interrupt, you are at entire liberty to correct any figures before the hearing is printed.

Mr. SINKLER. Yes, sir.

That is just about correct, by my information, Senator. We can file that, but 35 million sounds about right to me for total production.

Senator THURMOND. You can correct these. I have been given these figures as being the correct figures. France, 5.5 million; West Germany, 5 million.

Mr. SINKLER. That would be just about right.

Senator THURMOND. I don't have Japan.

Mr. MARGOLIS. 12 million. I think that's about it, Senator.

Senator THURMOND. Russia, 27 million; Japan, 12 million.

Mr. SINKLER. I think that is correct for Japan, France, and Germany, as I remember the figures. The Russian estimate sounds right, but, again, I would like to check that one from the correct sources. We'll file with the committee the official figure.

Senator THURMOND. I wish you would check these.

Then I have a number of watch movements produced in this country, jeweled movements, which would be 1.4 million.

Mr. SINKLER. Unfortunately, that one I remember very clearly, and that is correct.

Senator THURMOND. It is amazing to me, Mr. Chairman, and I think it will amaze the American people, to see that Switzerland, for instance, is producing 46 million watch movements, 35 million of which are jeweled movements; France, 5.5 million; West Germany, 5 million; Russia, 27 million; Japan, 12 million; and we, the greatest country in the world, are producing only 1.4 million. I think that these figures ought to be called to the attention of the American people, because I do not believe they would approve of any policy that permits other countries to send into this country watches to the extent that they have just about destroyed the industry in America.

I believe 86 percent, now, of the American market is consumed by watches from foreign nations, is it not?

Mr. SINKLER. That is correct.

Senator THURMOND. Eighty-six percent?

Mr. SINKLER. Yes, sir.

I might add that of the 86 percent of the jeweled-lever watches sold in the United States, my own company, Elgin, and Bulova combined probably account for more of those than any other three companies you could put together. But we have been forced into the importing of Swiss movements in order to remain competitive pricewise.

Senator THURMOND. Now, your statement and the information that I brought out this morning about the essentiality of the watch industry to national defense in the manufacture of missiles and in other defense equipment and weapons, it seems to me, is overwhelming, is absolutely astounding to see how important the watch industry is to our national defense. Yet we are allowing it to gradually become extinct. I do not think we can permit this to continue. I hope that this information can be brought to the attention of the proper authorities in the executive branch and that they will take the necessary action to discontinue such a policy, and if they do not do it, it seems to me it is incumbent upon the Congress to do it.

Not only is it important to our national defense, but I think, too, as a matter of—of course, that does not enter into the matter here, but as a matter of trade, too, of allowing any and all the countries to send in here 86 percent of the market of anything that America uses, where we can produce that ourselves.

I do not think I have any other questions. I just wanted to have those figures verified, so will you place in the record those figures you have. Thank you, Mr. Chairman.

Mr. SINKLER. Indeed I will, Senator.

(The above information will be found on pp. 280–288.)

Senator SYMINGTON. Apparently from your record, you came out of a plant, did you not?

Mr. SINKLER. Yes, sir.

Senator SYMINGTON. Let us talk a little shop. In my day, a machine-shop apprentice took 3 years. Is that still true?

Mr. SINKLER. Our apprentice program runs slightly longer than that, Senator. It is a 5-year program which we operate for——

Senator SYMINGTON. I heard it had changed to 5 years. Now of course, after he becomes a full-fledged machinist, he is not yet a tool and die maker.

Mr. SINKLER. We call him a full-fledged machinist, but he still has more work to do to be the other, yes.

Senator SYMINGTON. As I understand the testimony here, it takes 10 years to make a full-fledged tool and die maker.

Mr. SINKLER. We would judge at least that, yes, in our industry.

Senator SYMINGTON. By a tool and die maker, you mean a man who could work off a set of prints to create tools to these close specifications?

Mr. SINKLER. That is exactly right, and be responsible for it until the finished piece matches the drawings and diagrams.

Senator SYMINGTON. If your tools and dies aren't right, your finished piece is not right?

Mr. SINKLER. That is right.

Senator SYMINGTON. We were listening this morning to some testimony about substitute sources. During World War II, I was chairman of the Shell Booster Committee of the War Department, Army Ordnance. We were spreading out the production of boosters and had a great deal of trouble, even with the relatively broad tolerances on them; brass bar stock produced these units. I remember a fine washing machine company that nevertheless had had no experience in making boosters and they had much trouble. You are bound to run into such problems regardless of the ability of a company in another line, are you not?

Mr. SINKLER. That is correct.

Senator SYMINGTON. You get into the question of how much time it takes to have a man, or a corporation, learn a particular art.

Mr. SINKLER. That is completely correct. There are a great many highly specialized toolmaking machines which our people are experienced at using, which find no counterpart in any other industry that I know of. So there is also no ability to make the tool, as well as operating the special tools used in producing it.

Senator SYMINGTON. In World War II, there was a famous development in the gyro art. Dr. Draper at MIT, was responsible for it, a gyro computer installed on warships enabled the ships to be phenomenally successful in resisting attack by aircraft. The Air Force was interested in getting it on planes. They asked the company I was connected with if we would take a crack at it. We said we would, provided they could find somebody who could do the complicated electronic work. There were only three, perhaps four, companies which could.

Each of these companies had high-priority orders, however, to the point where none of them could take this additional work on. Certainly, we lost some fliers because we could not adapt the concept of gyro computation into aircraft. In your opinion, would not that situation be possible in a case like this, where war caused a sudden avalanche of additional requirements of this type and character?

Mr. SINKLER. I think that is completely so, Senator. The people working in the watch industry find it so highly specialized that we have to run our own apprentice training courses. We cannot go out and hire watch engineers. We can hire very capable young men who, in time, will learn the skills that they need, but they are not readily available. That is why the lesson is so important, to keep the whole operation, the whole manufacturing facility, the engineers, the tool and die makers, the assemblers, the machine operators, all working at their skills, because if they are not working at their skills, in an emergency you cannot put them back together again and you cannot go out and hire them.

Senator SYMINGTON. In my State, whereas many people would think there were more per capita older people in States like Florida or California, there are more per capita older people in Missouri than there are in any other State in the Union except Iowa. Probably the reason is the future on the farms. We are an agricultural State. When you have a situation like this, with a slow but steady attrition of people in an industry, does not that, to some extent, prevent young people with a flair for this type and character of work from going into it as against going into say the electronic field, or the nuclear field?

Mr. SINKLER. Oh, it is a terrible problem. Our industry has been kicked around quite a bit in the last few years, and the young men have to be persuaded that we have a future before they will sign up.

In addition to that there is the decreasing employment that we have. Our average age is creeping up all the time, so that we now have, as I remember the figures, something more than 15 years of service at the bottom of the seniority list.

Now, that prevents us from going out and hiring the young men to replace these oldsters when their time to retire comes. So we have a double-barreled effect.

If you have a shrinking business, you cannot hire new employees, and if you have a business whose future is somewhat questionable because of propaganda and publicity put out by the opposition, it is darned hard to persuade them to come to work for you.

Senator SYMINGTON. These questions were stimulated by what I heard this morning, and also by some information read over the weekend by Mr. Braswell, an able member of our staff, who has been working on this.

Thank you, Mr. Sinkler. We appreciate your testimony.

General Bradley, who is your next witness?

Mr. SINKLER. I shall introduce them, Senator.

Senator SYMINGTON. Yes; I beg your pardon.

Mr. SINKLER. It is quite all right. I shall just stay where I am. The hardware is there.

First of all, Mr. Donald Sites, who is the director of our military and industrial products division. He started his career at the Naval Ordnance Laboratory, and fortunately, we were able to persuade him that we had a future in 1959, and he has been with us ever since. He is now director of all the operations, including the research as well as production of these items.

Senator SYMINGTON. May I make a suggestion? We are moving ahead as rapidly as possible. Perhaps, instead of showing these instruments, you could file for the record a statement; and say this is what you have, emphasizing the close tolerances; put it all in the record.

Mr. SINKLER. That we can easily do if we shall run out of time otherwise.

Senator SYMINGTON. If you think it important enough, I shall be glad to have you come down some other time.

Mr. SINKLER. I would agree with the Senator, would you not, General Bradley, that it would be better to file it?

General BRADLEY. Yes.

(The statement of Mr. Sites follows:)

STATEMENT BY DONALD K. SITES, DIRECTOR, MILITARY AND INDUSTRIAL PRODUCTS, HAMILTON WATCH CO., LANCASTER, PA.

In order to describe Hamilton's participation in the defense industry during the 10-year period since the last Senate hearing, I would like to present a brief chronology of our accomplishments using only a few of our typical projects to demonstrate our capabilities and to illustrate the essential nature of our industry within the defense industry.

In about 1954 when the last Senate hearing was held, Hamilton's primary defense activity was centered around the production of the MK-15 safety and arming device which was used on proximity fuzes for the Navy's 3-inch projectiles. Volume production of this device was discontinued shortly thereafter, however, and Hamilton began to redirect its capabilities into more exotic and sophisticated development activity.

One of the significant contributions that Hamilton made during this period of time was to participate in the design, development and manufacture of the MK-3 safety and arming device shown here which is used in the Sidewinder missile. We were called upon by the Navy's Bureau of Ordnance (now the Bureau of Naval Weapons) to solve several serious design and manufacturing deficiences which we accomplished. In doing this we, in fact, solved certain problems, particularly in the timing device itself, that neither the Navy or the Eastman Kodak Co. had been able to solve up to that point. These solutions enabled us to proceed with production of over 14,000 of these items, and in fact, finally enabled Eastman Kodak also to produce the weapon. I feel this was just one example out of many where the knowledge peculiar to our industry was necessary to alleviate serious design problems.

A footnote to this project just occurred several months ago. In May of this year, 1964, Hamilton was asked to undertake the production of a critically needed item for use in southeast Asia. The delivery requirements were literally impossible and, in fact, so unreasonable that we at first declined to undertake the task. Special pleas to our corporation pointing out that this need was imperative and that we were one of the few companies in the country today who could accomplish the task forced us to reconsider and tackle the job. We rolled up our sleeves and met the almost impossible demands by tooling for and producing 5,000 of the XM-423 S. & A. devices (shown here) within 10 weeks after the order was placed. Notice the similarity of this device to the timing heart of the Sidewinder device built 6 and 7 years ago. Our experience and prior knowledge relative to this device was invaluable to the Government when this emergency procurement requirement arose.

This seems to be the order of the day for us, receiving the almost impossible chores when all else and everyone else has failed, but we also like to think that it presents one of the reasons why we are here and why we will always be here—simply because we are needed. Now, let me go back to the midfifties again to further describe our activities at the Hamilton Watch Co.

One of the next challenges issued to Hamilton came from the Diamond Ordnance Fuze Laboratories (now known as the Harry Diamond Laboratories) to develop and produce a safety and arming device for the Navy's 5-inch Zuni rockets. You may remember the name Zuni from the recent press releases of the North Vietnamese PT boat incident where American aircraft utilized the Zuni rocket to damage and drive away the enemy boats.

It is noteworthy that HDL turned to Hamilton because three other nonwatch companies had previously attempted to accomplish this development and had failed. Hamilton, using the skills, experience, equipment, and knowledge available only within the American watch and clock industry, accomplished the assigned task and in doing so even developed a new escapement (which, incidentally, we produced and furnished to another company for use in the Nike S. & A.). This development was followed by tooling requirements which our production know-how easily accomplished, and we later delivered over 10,000 of these devices.

Later modifications of this item resulted in the rapid and inexpensive development of a flare fuse for the Zuni weapon system. This fuse initiates a black powder charge at a preset interval of time following launch which in turn ignites a flare, thereby providing target illumination for subsequent air attack.

Hamilton's experience and the availability of this device was called on again at a later date when a timer was needed for the Atlas I recovery system. Hamilton engineers, noting that the reentry characteristics of the Atlas were quite similar to the launch acceleration characteristics of the Zuni, were able to easily, quickly, and inexpensively modify the S. & A. to fulfill this new requirement. The timer contained in the nose cone of the Atlas recovery vehicle, releases at spaced intervals, beacon dye packages which send out radio signals and emit a dye to assist in locating and recovering the reentry vehicle.

As recently as 1963, the Army drew again upon Hamilton's experience and upon this same basic mechanism to further modify and refine the device for use in the new M–55, 5-inch bombardment rocket. The unit now initiates an additional 90-second timer, lines up the explosive train, releases a firing pin, and initiates a thermal battery power supply. This delayed arming technique achieves the safety factor deemed so critical in this new weapon. Utilizing one basic concept and spanning about 8 years, we see how one segment of the American watch and clock industry has capably satisfied no less than four separate needs of our Defense Department.

This device, however, does not even partially describe the magnitude of Hamilton's accomplishments since 1954. At about the same time that the Navy's 5-inch Zuni program needed help, the United States began to develop its arsenal of intercontinental ballistic missiles. One of the first of these missiles, and in fact the direct descendent of the German V–2, was the Redstone missile. Hamilton developed and produced the safety and arming programer for this missile and, in fact, was the sole source of supply for every Redstone S. & A.P. ever produced. This was the first of the programer-type S. & A. devices, a completely new device that began the evolution from mechanical fusing such as had been long employed in mortars and projectiles to the more sophisticated electromechanical and electronic devices used in today's weapons. Hamilton accomplished this assigned task as requested and as scheduled, again largely due to the availability of skills and experience present only in the American watch and clock industry.

The items which I have discussed thus far require only the capability to function over relatively short periods of time. Defense needs, however, often require devices with function capabilities for much longer periods of time. Where else but the American watch and clock industry would you expect to find the answer to this requirement? During the late fifties, both the Army and the Navy came to Hamilton to solve such problems.

The Picatinny Arsenal had been given the responsibility for securing a special switching timer that could operate reliably up to 30 minutes. Hamilton was contacted and the design and development of this timer is now history. Utilizing a modified watch movement as the timing base and by originally designing a special switching assembly, Hamilton completed the development of this device and later built over 1,200 of the items. These timers are now deployed in the field as an integral part of a highly classified weapon system. The device shown here is settable in 5-minute increments from 5 to 30 minutes, must maintain severely prescribed accuracy from minus 65° F. up through 160° F. and must be highly reliable. These requirements literally exclude almost all but the American watch and clock industry from being able to comply satisfactorily.

I mentioned before that both the Army and the Navy came to Hamilton with long time delay problems. The Navy, through its Naval Ordnance Laboratory at Silver Spring, Md., had a requirement to develop an underwater demolition-firing device for use by frogmen and similar specialists. Again, using a watch movement as the basic timing mechanism, Hamilton originally designed and developed the MK-23 timer shown here. This device can be set at any time between 15 minutes and 12 hours to release a firing pin. Very minor modification can even, in fact, allow the timer to be used for timing functions as low as 5 minutes and as high as 120 hours. I know of no other industry that can satisfy these particular requirements within the schedule and funding limitations that exist today.

In 1957 the Hamilton Watch Co. marketed the world's first electric watch. It wasn't too long thereafter that the Navy came to Hamilton with an interesting new requirement. A device had long been needed in underwater mines which would replace the explosive and automatically record the exact time the mine would have been actuated by a passing ship—for use in war games, naval maneuvers, and for the plotting of potential minefields. The electric watch modified and ruggedized to withstand ocean impact from air drop and sealed to withstand submersion to depths up to 200 feet, was a natural for this application. Hamilton developed the MK-17 underwater fire recorder and has been the sole supplier of over 1,000 of these items to the U.S. Navy to date. This is an excellent example of the defense industry benefiting from company sponsored and financed development activity.

In 1960 the Sandia Corp. asked the Hamilton Watch Co. to develop an extremely complex, dual channel, escapement regulated 12-hour timer for inclusion as an integral part of a highly classified weapons system. This timer is shown here. It is our understanding that the need for and use of this weapon system place it among the more important developments today.

The efficiency and reliability requirements demand several state-of-art advances. Tolerances in many places exceed those of the finest watch parts. It is, in fact, one of the most precise mechanisms we have ever made. I can say categorically that this item could not be produced outside of the watch industry within any reasonable cost or time.

Senator SYMINGTON. Who will be your next witness, Mr. Sinkler?

Mr. SINKLER. Mr. George Ensign, director of corporate research for the Elgin Watch Co.

Senator SYMINGTON. Would you simply make a statement for the record and give it to our clerk? Would you raise it so that we can look at it? Do you have anything you want to say?

STATEMENT OF GEORGE G. ENSIGN, DIRECTOR, CORPORATE RESEARCH, ELGIN WATCH CO.

Mr. ENSIGN. I was going to speak simply from notes, rather than a prepared statement.

Senator SYMINGTON. Would you file that statement?

Mr. ENSIGN. I can.

Senator SYMINGTON. Thank you.

(The complete statement of Mr. Ensign follows:)

STATEMENT OF GEORGE G. ENSIGN, REPRESENTING ELGIN NATIONAL WATCH CO.

My name is George G. Ensign. I have been with Elgin National Watch Co. in various engineering capacities since 1936. During World War II, I was chief of production engineering, general superintendent of the company's fuse production facilities, and a member of the industry mechanical time fuse coordinating committee. After the war, I was made director of research and development at Elgin. My present assignment is director of corporate research. The defense and industrial group at Elgin is composed of Elgin's Precision Products, Communications, Micronics, and R. & D. Divisions. Nearly 100 percent of the work of this group is performed directly or indirectly for the Federal Government. Net sales of the group last year amounted to approximately $30 million.

I have prepared and attached to my statement a summary of some of the defense and defense-related work we have performed at Elgin in recent years. The nature of this work reflects clearly, I believe, the unique competence of the watch industry to design, develop, and mass produce miniature, precision parts, components, and mechanisms to very close tolerances. It is not the ability merely to do any one of these basic tasks to the exclusion of the others, but rather the combination of all these abilities which is the source of the industry's importance to the national security. Other industries, because of the nature of their commercial product, may possess some of these abilities—sometimes two or three of them. The manufacture of camera shutters, for example, requires application of many of these skills. The parts comprising the shutter, however, are much larger than those of a typical watch. Precision instruments are rarely mass produced and are therefore subject to much more individual adjustment and attention in production than a watch. Electronic apparatus may be extremely small, but its parts do not move.

This unique combination of skills or abilities has given the watch industry a unique position as a supplier of certain types of defense and defense-supporting items. For example:

1. There is a group of defense items that can only be produced within a practicable period of time by jeweled watch companies. Very precise, dependable military and essential civilian timepieces, such as marine chronometers, navigation watches, chronographs, stopwatches, certain aircraft clocks and the like, are included in this group, as are a variety of highly complex and intricate timing and safety and arming mechanisms.

2. There is another large group of defense items that other companies can and have produced, but only after a time-consuming, up skilling of personnel, and a learning of new techniques. Production of items in this category has been a relatively simple task for the watch companies, since skill requirements for the manufacture of such items are somewhat less exacting than those experienced in watch work. For this reason, the record of the watch companies—in terms of leadtimes required, quality of product, cost to the Government and frequently in three of these respects—is definitely superior to that of other producers. Typical of the items in this category are certain specialized types of fuzes, fuze components, safety and arming devices, timing mechanisms, and precision instrument parts.

3. There is a third group of defense items which companies both inside and outside the horological industry are presumbaly equally competent to manufacture—a notable example—some of the mechanical time fuzes. But in this category, as well as in the first two mentioned, the horological industry has repeatedly demonstrated a special ability, traceable to its watchmaking experience and know-how, to perfect and refine designs and to improve upon existing manufacturing methods.

4. There is yet another group of defense and defense-related items that owe their very existence to the watch industry and, in particular, to the efforts of the industry to improve its commercial product. Included in this group are special precision tooling, machinery, and testing equipment, low-temperature lubricants, special alloys, subminiature motors and the like. There is every reason to believe that they would be unavailable today but for the continuing efforts of the jeweled watch industry to develop and produce better timepieces.

5. Finally, the industry makes a special contribution to the constantly evolving technology upon which modern military preparedness increasingly depends.

New weapons and equipment are being developed and tested. Current ordnance items are being continually redesigned and improved. Emphasis increasingly is being placed upon the development of miniature and subminiature components and end items that are both more compact and more reliable. This, of course, is the watch industry's forte. The experience of the watch companies over the past few years in designing, engineering, miniaturizing, and refining key parts and components for the armed services and for other military contractors gives clear indication of the growing role the industry is playing in the development of timing and control systems for a host of new military items.

The skills which make for this unique combination of abilities are themselves interrelated and interdependent. They include both technical skills (designers and engineers for both the product and the machinery which goes into its manufacture) and production, assembly, adjustment and inspection skills of a high order. As in few other industries, it is the organization—the totality of talents found in the watch industry—that establish its value to national defense.

A closer examination of the skills employed in the manufacture of jeweled watches will demonstrate this basic fact. A fine jeweled watch represents the highest order of precision engineering. It is one of the most compact, delicate, precise, and efficient mechanisms ever devised and produced, and, at the same time, one of the sturdiest. Within a volume considerably smaller than three stacked dimes there are crammed from 140 to 160 tiny, individual parts, some of which are barely visible to the naked eye. The whole watch manufacturing process, in fact, an industrial world all of its own, is characterized by operations in extreme miniature.

In recent years Elgin has found it increasingly difficult to compete as a watch producer with the importers of foreign timepieces. As a result, we have turned increasingly to imports ourselves. While many skilled personnel have been transferred into the industrial group, many more are gradually being forced to abandon their skills in favor of employment offering a better future. Others are retiring without having the opportunity to pass their skills on to the next generation. These skills can only be acquired by years of experience, by working side by side with those who have mastered them. Just as you cannot train any man to be a salesman, you cannot train any man to work in the miniaturized dimensions of a watch. You can explain the principles and shortcuts and give him the fundamentals, but only experience will develop his skill. And just as a good salesman develops an undefinable sixth sense to know what to say and when to say it, so does a watchmaker develop senses which enable him to drill, fit, aline, polish, and adjust the tiny parts which comprise our product. We at Elgin believe that once lost, the skills and technology of the horological industry will be virtually irretrievable.

It has been discouraging to see those skills disappear at Elgin. In 1953 we had 3,834 persons employed on watch work at Elgin. Today there are less than 900. A few days ago we were forced for financial reasons to dispose of our research facility at Rolling Meadows, Ill. Fortunately, that plant was acquired by General Time Corp., and the personnel employed there will have a continuing opportunity to utilize their skills in similar activities as part of a watch and clock making organization. Frankly, I doubt whether we could have taken on several of the assignments discussed in the list I have attached to my statement with the staff we have at Elgin today. But we are also fortunate at Elgin in having within the company a nucleus or cadre of trained horological scientists, engineers, tool and die makers, and machine and assembly workers, a base from which we can, given the proper economic climate, rebuild and expand. I have been with this business for 28 years and have seen enough of its contributions to our country's defense posture to express the fervent hope that we will be permitted this chance.

RECENT AND CURRENT DEFENSE WORK PERFORMED BY ELGIN NATIONAL WATCH CO.

1. Designed and developed the XM–423 and XM–427 fuses for the Army Munitions Command for use in the 2.75 inch, folding fin aerial rocket. This particular fuse (the XM–423 and 427 are sister Army-Air Force versions) is governed by a verge-type escapement. It is designed to detonate the rocket's warhead upon impact with soft or hard targets at extremely oblique angles and is presently in volume production by Day & Zimmerman, Hamilton, and perhaps others.

2. Designed and developed various types of inertia switches for use in rocket and missile systems. One of these is employed in the underwater-to-air-to-under-

water nuclear Subroc missile; another to ignite the second stage of the Terrior; a third is used as a time-delay device on the Green Quail decoy rocket.

3. Designed and developed various types of interval timers, each of which contains a watch-type escapement. One of these, which we production engineered for Frankford Arsenal, functions so as to release a firing pin for detonation of an explosive primer after the field-set time interval (from 7 minutes to 48 hours) has elapsed. Another, developed for Picatinny Arsenal, is designed to be air-dropped into the sea from a height of 10,000 feet, sink 4,000 feet into the water and then initiate the explosion of a sofar bomb. The sofar system (standing for sound fixing and ranging) is employed to fix the locations of vessels in distress, downed pilots, enemy submarines, etc., where radio transmissions are impossible or undesirable.

4. Designed, developed, and produced pulse switches or counters for Picatinny Arsenal, the end use of which is not known to the company. These counters have as their heart a modified jeweled watch movement in which the balance wheel has been replaced by a miniature electromagnet—one of the fruits, incidentally, of our electric watch research. A very similar device made by Elgin has had an interesting nonmilitary application. Designated a cardio-counter and weighing less than 3 ounces, it is worn on the person to record heartbeat signals for medical patients and psychological stress-type testing.

5. Elgin has developed a number of different programers or programing switches for a variety of space and military applications. One of these, designed for use in satellites, contains a miniature drive mechanism and 17 switching circuits; another smaller device of similar construction is used in a classified application to encode or decode events in sequence; two others, incorporating modified watch movements, were designed and produced for NASA (for detecting and measuring magnetic fields in space) and for General Dynamics (for use as a part of the telemetry system in the Centaur missile).

6. Designed and developed a broad line of miniature elapsed time indicators. These ETI's are extremely accurate time-measuring devices, designed to meet rigid military specifications for accuracy, reliability, and environmental indifference. Since 1958, Elgin has sold over 150,000 of these units to the armed services; to aircraft, missile, and space systems contractors; and to manufacturers of radio, radar, counter-measure, computer, navigational, and testing equipment. The ETI's, of course, are basically time-keeping and time-indicating mechanisms and, as such, their development, tooling, and production has involved a wide range of watchmaking skills and techniques. It would be impossible to describe in detail here their many applications. They are employed, for example, in the TFX, the B–52 and B–58 bombers, and in teletypewriter routing systems used by all three services. A closely related instrument is to be mounted on the exterior of Agena rockets where, viewed from the Gemini spacecraft, they will serve as a fuel indicator in terms of propulsion time remaining. Many of these ETI's contain a subminiature 400-cycle gear motor designed by Elgin. Utilizing watch size pinions and gears in a jeweled spur-gear train, this motor is but three-eighths inch in diameter by three-eighths inch long and weighs less than a nickel.

7. Elgin also has developed a spring-powered motor for Goddard Space Flight Center for use in satellites to extend a magnetometer boom on command from a ground station after the vehicle is in orbit.

8. Currently developing,[1] under contract with North American Aviation, the central timing equipment for the Apollo spacecraft and LEM (Lunar Excursion Module). This unit will perform all the automatic timing functions for the space capsule's equipment, including the synchronization of the capsule's television, telemetry, and test equipment. Among other things, it will control the jettisoning of the escape tower, synchronize trajectory correction, release and establish rendezvous with the LEM, fire rockets to leave the lunar orbit and enter earth-bound trajectory, and initiate and program reentry. Elgin has reduced the original design for the unit from the size of roughly three file cabinets to the size of a loaf of bread. Weighing only 10 pounds, it contains nearly 5,000 parts and has reliability guarantee of 1 million to 1 odds against failure.

9. Elgin is presently under contract[1] with the Naval Weapons Laboratory to design and develop, in connection with the Navy's HERO program, a coaxial

[1] This contract has been taken over by General Time Corp., which in the past few weeks acquired from Elgin the latter's research facility at Rolling Meadows, Ill.

relay or safety device which will prevent the misfire of naval weapons aboard ship by the ship's own radar beams which can and have actuated prematurely the electrically fired weapons systems.

10. Several years ago Elgin developed a special noncorrosive and durable alloy (Elgiloy) for an unbreakable mainspring for its watches. The new alloy (which the Swiss later copied) is nonmagnetic and highly resistant to corrosion, fatigue, set and temperature change. It has found wide usage in military instrumentation including drive bands for radar fire control systems; drive control equipment for handling radioactive materials; torsion bars for rate gyros; springs for missiles, fuses, aircraft engines, jet aircraft reconnaissance cameras, etc. Many of its applications have been made possible by employment of metals processing facilities and techniques developed at Elgin for the manufacture and processing of watch parts. A recent illustration of the utilization in combination of Elgiloy and the company's metals processing capability has been the drawing of fine 0.000685-inch diameter, Elgiloy filament wire to be woven into a fabric which will be tested in a classified, extremely high-temperature application.

11. Designed, developed and produced thousands of the MK–304 safety and arming device for the Sidewinder air-to-air missile. Like many such S. & A. devices, the MK–304 incorporates an escapement mechanism for integrating time and distance against gravity forces. No other company, to our knowledge, has made this version of the Sidewinder device. An earlier version, the MK–3, was pilot produced by Hamilton and was an adaptation of the 2.75-inch MK–176 rocket fuse.

During the Korean war, Elgin produced almost 1½ million of those fuses for the military. In recent years we redesigned the MK–176 for inclusion in the Pogo-Hi sounding rocket, used in connection with atomic testing to sense radiation at various air levels. Elgin has produced a number of these Pogo-Hi switches or fuses and, so far as we know, has been sole supplier of this item. Elgin has also produced over 200,000 units of a different version of this device, the T186E11, for use in mortar rounds. The solutions developed by Elgin for a number of problems it encountered in producing the T186E11 fuse have been incorporated in newer designs of this item.

12. Back in 1956, Elgin was awarded a contract by the Diamond Ordnance Fuse Laboratories to redesign the safety and arming mechanism for the Nike missile. The original S. & A. for the Nike, designed by a nonwatch firm, had proved deficient in a number of respects, and Elgin's assignment was to correct those deficiencies, particularly in the escapement and gear train, to reduce its cost and, generally, to make the device more reliable and readily producible. Elgin engineers, toolmakers and watch production personnel collaborated to achieve these goals and, among other things, cut the cost of producing the Nike S. & A. by 50 percent. Ultimately designated the M–30 (and later, the M–30A1), the Nike S. & A. device has been volume produced by Elgin. So far as we know, we have been the sole producer. In addition, Elgin has modified the M–30A1 for Douglas for the Genie missile and, in still a different design, for the Nike-Hercules and the Nike-Zeus antimissile missile.

13. Working in conjunction with engineers from Picatinny Arsenal, Elgin designed and developed the XM32E–4 and E–6 safety and arming devices for the Army's surface-to-air Hawk missile. The work was awarded to Elgin on an emergency basis after the original, nonwatch company contractor had experienced difficulties with the delay-type escape mechanism. The XM32E–6 is essentially the XM32E–4 with the inclusion of an additional shorting switch found necessary for safe operation. The modification was effected by Elgin and field units shipped approximately 3 weeks after Picatinny advised us of the urgent need for the change. Thus far, Elgin has produced a sizable classified quantity of these S. & A. devices for the Hawk. Another contractor outside the watch industry was awarded a production contract in late 1961 for July 1962 delivery. Elgin's contract in effect at that time was considerably expanded when it became clear that the other contractor would have difficulty meeting its contract schedules. In fact, the other contractor was 18 months late in deliveries of this item. Elgin has assisted in NATO training and tooling of Hawk production by supplying, through Picatinny, sets of parts, various production data, etc. Elgin has also trained NATO personnel in production of the Sidewinder and M–30A1 S. & A. devices.

14. Elgin continues to be a volume supplier of fuses and fuse components for the military. For example, during the past 2 years it has received contracts for the manufacture of over 1,800,000 artillery shell booster assemblies (basically a

time delay-arming mechanism to prevent premature bursts, and incorporating a watch-type gear train. It also has produced a classified quantity of Blu 4 high explosive bomb fuses. While other companies have participated in Blu 4 procurements, Elgin has been advised that its record for quality on this item has been unmatched by any other supplier. During the first part of this year, it was awarded a contract for over 2 million Blue 3/B fragmentation bomb fuses.

15. Elgin has also continued to be a volume supplier of critical parts and components for other defense contractors, notably delay assemblies and timing blocks for Avco Corp. (for use in the Polaris missile); precision gearing for Bendix (for use in air data computers, air data sensor systems and roll stabilizer compass compensators); and tape punches for Teletype Corp. (for use in teletype equipment).

16. Designed and developed for the Navy Ordnance Laboratory in Corona an air-dropped, underwater, sound-signaling device for use in antisubmarine warfare training. The device is preset for time and pressure, maintains the unit safe until it senses parachute deployment shock, and, upon reacting to the designated pressure, triggers a time base which sets off a low-order explosion.

17. At the suggestion of the Naval Ordnance Laboratory at Corona, the Aeronutronic Division of Ford-Philco in 1959 requested Elgin to design and develop a complex program timer for use in decoy systems for the Atlas and other ICBM missiles. With permissible timing tolerances stated in milliseconds and the requirement that those tolerances be maintained over a sustained period, this is an extremely complicated device. Elgin has produced a large number of these timers under followup contracts from Aeronutronics and, so far as it knows, has been the sole supplier of this item. The company has also designed and produced for Hughes Aircraft and the Holloman Air Development Center, a highly accurate special type of timer for use on target drones to release and ignite target flares for missile practice.

18. Personnel from the Navy Bureau of Ordnance met with a group of Elgin's engineers in late 1954 and requested Elgin to undertake the miniaturization and complete redesign of a high-precision, electro-mechanical, safety-and-arming mechanism for the Navy's air-to-air Sparrow missile. The Navy hoped to obtain a safety-and-arming device that not only was much smaller but also less expensive than the existing model. Feasibility studies conducted at Elgin indicated that the Sparrow device could be considerably reduced in size and complexity, and the company was accordingly awarded a research and development contract. Working with engineering personnel from the Naval Ordnance Laboratory at Corona, Calif., Elgin completely redesigned the existing device—reducing its weight and size by a ratio of 3 to 1, its complexity by a ratio of 5 to 1 by reducing the parts (although the simplified Elgin model itself contained approximately 100), and cost from $1,500 to approximately $225 per unit.

Elgin was able to accomplish all this because of its watchmaking experience and skills. Tools for all of the mechanical parts, for example, were designed and made at Elgin by watchmaking personnel. Assembly was handled at the company's Burbank (California) plant under the supervision of persons "drafted" from the watchmaking developmental activities at Elgin. Moreover, when Elgin was unsuccessful in its efforts to obtain a tiny solenoid for the device from outside sources, it utilized personnel engaged in work in its electronics division to develop a special solenoid for this purpose. Similarly, the device contains a subminiature rotary switch which was designed and built at Elgin by people involved in Elgin's watch research activities when efforts to purchase a switch of such small proportions from precision switch manufacturers failed.

Elgin later redesigned and modified the Sparrow S. & A. for use in the Tartar and Terrier missiles. The company has produced several hundred of these units for the Terrier and Tartar. A complicated mechanism, the S. & A. has close machining and time-base tolerances, requiring a failure rate of less than 1 in a million parts. Elgin has also designed, developed, and produced (for Convair) a program timer for use in the Tartar-Terrier series.

19. Because of its work on the Sparrow, Elgin was awarded the contract to design and develop the MK 312 fuse for use on the Bullpup air-to-surface missile. This is also a complex device, designed to meet exacting timing, reliability-of-function, and safety requirements. Design was accomplished in 18 months. Several thousand of these devices have been produced by Elgin under followup contracts. A number of these Bullpup fuses were also produced at the Government's ordnance facility at Macon, Ga. When difficulties were encountered at

Macon, the Navy awarded a second-source production contract to Bulova. Elgin's most recent contract was received in April of this year. The company also was engaged in 1962 to redesign the MK 312 Bullpup fuse for use in the Bullpup B. The newer fuse, the EX–60, has a recycle capability and a higher reliability requirement to adjust for the higher velocity and impact shock of the "B" version of this missile. Elgin, in addition, has designed, developed, and produced thousands of special triggering devices and has produced a number of high-precision contact drums for the Bullpup.

20. Because of its experience with the Bullpup, Elgin was selected to design and develop the safety and arming device for Navy's new Shrike air-to-surface missile. Containing a time-based distant integrating mechanism, developmental work on this device is substantially completed and it is expected that production will shortly be ordered.

Senator SYMINGTON. Mr. Sinkler, anybody else?

Mr. SINKLER. Just two; Mr. Sites of Hamilton and Mr. Ensign of Elgin.

Senator SYMINGTON. Could you handle that the same way, Mr. Sites?

Mr. SITES. Yes, sir; I would be happy to.

Senator SYMINGTON. We, of course, will furnish these hearings to the people who make the decisions in these matters. Did you file a prepared statement?

Mr. SITES. Yes, sir.

General BRADLEY. Our next witness, Mr. Chairman, is Mr. George Fraker, who is vice chairman of the General Time Corp., because we are interested in showing that we are interested in the watchmaking capability for jeweled watches and nonjeweled watches. He also has a written statement he would like to file on behalf of the Ingraham Clock Co.

Senator SYMINGTON. Mr. Fraker, do you have a prepared statement?

STATEMENT OF GEORGE W. FRAKER, VICE PRESIDENT, GENERAL TIME CORP.

Mr. FRAKER. Yes, sir; I do. I would also like to file a statement of the Ingraham Co. We are the only two clock companies left. I would like to note, if there is time—I would like to file both of my statements.

Senator SYMINGTON. The others have read theirs. We would be glad to have you read yours. The last two witnesses were only to present the technical aspect.

Mr. FRAKER. Thank you, Mr. Chairman.

My name is George W. Fraker. I am vice president of General Time Corp.

During the Second World War, I served in the U.S. Navy as Technical Procurement Officer in charge of procuring ammunition components, including fuses, safety and arming devices, for the Bureau of Ordnance.

From 1943 to 1946, I was Chairman of the Joint Army-Navy Mechanical Time Fuze Committee.

In 1949, I joined Elgin National Watch Co. as general manager in charge of Government programs. While I was with Elgin during the Korean conflict, Elgin produced in excess of 20 million fuses and safety-and-arming devices for the military.

In 1960, I joined General Time as vice president, Goverment relations. This is the position I now hold. I should add that I am also currently vice president and general manager of the Acronetics Division of General Time. General Time's Acronetics Division consists of five operating units engaged in highly significant missile, space, ordnance, meteorological, and oceanographic programs.

The rest of the statement I can file. I just wanted you to be acquainted with my background. As you can see, I have been "on both sides of the fence." I also have a good appreciation of both the jeweled watch industry as well as the clock industry. I would like to, if I might, make a few statements here based on some of the testimony that has gone before, from where I stand. I might say, during World War II, I had a good chance to observe all the clock-and-watch people when I was in the Navy. I might say that in these critical munitions programs, particularly fusing, it was the jeweled-watch people in particular that got us over a very critical hump. Right in back of the jeweled-watch industry were the clock people. They were the backbone of our whole fusing program for both services.

After we licked the problem, as I say, the jeweled and nonjeweled segment, it was fairly—not too difficult for the rest of the industry, like the Bendixes, the Edisons, and some of the rest of them to get into production. But if we had not had the know-how of a few of these very important technical people, believe me, we would have been in serious trouble.

I might say this, too, which Senator Saltonstall, just before he left, asked. During Korea, we found ourselves in a very serious problem. I was then with Elgin and we needed VT fuses the worst way. The bottleneck was the safety-and-arming device which we were getting which was the mechanical part of the VT fuse. We were making about half the quantity of VT fuses at our Lincoln, Nebr., plant, which no longer exists. Even then, I had to make an emergency trip to Switzerland, with the concurrence of the Navy, to buy 40 million pinions and gears because there was not the production capacity in this country, even though we were working all our machines three 8-hour shifts a day.

While I was over there, I did purchase about 300 such new machines. I would say we had to play second fiddle to the Russians, who were paying a premium and getting them off the line before we could get them.

The tragic thing today is although we have the capacity to buy all our stuff abroad like we do, we have less than half the screw machine capacity for this type of work that we did at the start of Korea. So I just want to be on record that we are really in a very serious condition if something should start.

I might say that, which is pretty true of the jeweled and nonjeweled industries, that most of the programs we are in, we are sole source in a great many of them, and the only reason we are sole source, as I am sure you are familiar with the procurement regulations today, is there has to be very good justification for the Government to go sole source to companies. These are very critical programs. They have to go to pros to get the job done. They cannot wait for false starts. We have been involved in several key programs. Right today, I might say that the muzzle-action fuze which, when I left the Navy in 1946, I was told, electronics is taking over, the electrical fuze is going to take its place, there is no need for the mechanical capability of the watch and clock industry—right today, we are in a critical program for a special requirement for the Army in South Vietnam, where they want a muzzle-action fuze which will guarantee them a buckshot approach in the mechanism of the 155-millimeter gun, yet have it be improved so that they do not blow up the gun. Again, the Government Development Activity turned to us, sole source, because we have had a production capability on this Junghans fuze.

The rest of the people, you can cite case after case where the various services have had to come to our industry.

I might also say that NASA's programs, as Dr. Coates said this morning, he turned to us for the electronic programer on the Tiros satellite, which had a very fine record.

Also, as a subcontractor to RCA on the programer I just spoke of, we have never had a failure.

To a lesser degree, we are working on an Apollo sequence timer.

I think that is all I care to say at this time in order to save time, sir.

Senator SYMINGTON. There seemed to be a thought this morning that the nonjeweled watch industry is growing and can pick up any slack developing due to attrition in the jeweled watch industry. Is it your opinion that both are needed?

Mr. FRAKER. They certainly are.

I might say at the close of World War II, I was assigned at United States Time Corp. to try to get squared away on some of the production problems. They have made good strides, but in the event of an emergency, they do not have the complete capability to move fast in these programs. This is what is needed. There is a very definite difference between the states of the art. They are about a step and a half ahead in the jeweled watch industry than the nonjeweled watch industry, as I see it, today. There are certain areas where they overlap, but when the chips are down, there are some finer points where you go to the jeweled watch industry today.

I have to tell my production people today that they should not be bidding on something. Maybe it is a little over our heads, but we shall get there some day.

Senator SYMINGTON. Thank you for your testimony.

(The complete statement of Mr. Fraker follows:)

PREPARED STATEMENT OF GEORGE W. FRAKER, VICE PRESIDENT OF GENERAL TIME CORP.

My name is George W. Fraker. I am vice president of General Time Corp.

During the Second World War, I served in the U.S. Navy as technical procurement officer in charge of procuring ammunition components, including fuses, safety, and arming devices, for the Bureau of Ordnance.

From 1943 to 1946, I was Chairman of the Joint Army-Navy Mechanical Time Fuze Committee.

In 1949, I joined Elgin National Watch Co. as general manager in charge of Government programs. While I was with Elgin during the Korean conflict, Elgin produced in excess of 20 million fuses and safety and arming devices for the military.

In 1960, I joined General Time as vice president, Government relations. This is the position I now hold. I should add that I am also currently vice president and general manager of the Acronetics Division of General Time. General Time's Acronetics Division consists of five operation units engaged in highly significant missile, space, ordnance, meteorological, and oceanographic programs.

General Time's principal offices are at 355 Lexington Avenue, New York. General Time has plants and laboratories in Stamford, Thomaston, and Torrington, Conn., York, Pa., La Salle and Skokie, Ill., two plants in Athens, Ga., and a recently acquired plant at Rolling Meadows, Ill. General Time has foreign plants located in Canada, Scotland, Brazil, Hong Kong, India, Mexico, and the Virgin Islands.

General Time's commercial manufacturing operations in the United States today consist primarily of the production of clocks of all types, pocket watches, industrial timing devices, and time recording equipment. In addition to these commercial operations, General Time is increasingly manufacturing for the military and space agencies under Government contracts and subcontracts.

In 1954, Preparedness Subcommittee No. 6 of this committee held extensive hearings inquiring into the essentiality to the national defense of the U.S. horological industry. The subcommittee found that "the highly skilled workers in the American watch and clock industry, who require long years of training and experience, and their unique ability to develop and produce within the shortest time possible, precision instruments to minute tolerances, are essential to the national defense." For these reasons, the subcommittee concluded that, "therefore, it is in the interest of national defense to keep this essential industry alive and vital."

I wish to make it abundantly clear that Subcommittee No. 6 was referring, not just to the jeweled watch industry, but to the entire U.S. horological industry, of which the manufacturers of clocks and pin-lever watches constitute a major part.

At the outset of the 1954 investigation, there appeared a tendency for the proceedings to be dominated by consideration of jeweled watch manufacturing skills and production know-how, and for the clock and pin-lever watch manufacturing industry to be relegated to a subordinate position in the subcommittee's study. Accordingly, the manufacturers of clocks and pin-lever watches directed the attention of both the subcommittee and the Department of Defense specifically to the question of the defense essentiality of the clock and pin-lever watch industry.

Based upon its consideration of this challenge and the evidence submitted by the clock and pin-lever watch producers and the Department of Defense, Preparedness Subcommittee No. 6 found that the entire American watch and clock industry, not just the jeweled watch segment, is essential to the national defense. As for the position of the Department of Defense, then Assistant Secretary of Defense Thomas P. Pike made that crystal clear when he told the Preparedness Subcommittee on June 30, 1954:

"In general from the standpoint of the Deparment of Defense, and speaking strictly to the national security, the national defense angle of this problem, I can wholeheartedly concur in the general conclusions reached by Dr. Flemming in regard to the entire horological industry. And by that I mean not only the jeweled-watch industry but, in addition thereto, the non-jeweled-watch industry, and the clockmaking industry.

"There is no question but that the skills involved in these several industries, constituting in its entirety what we call the horological industry, are vitally essential to our national defense in the event of mobilization. As your committee knows, the Department of Defense has submitted a report to Dr. Flemming as one member of his interdepartmental committee, in which we addressed ourselves only to the jeweled-watch segment of this total horological industry.

"However, the total job done in our report constituted a very searching and careful inquiry into our 3-year mobilization requirements for watches, clocks, timepieces of various descriptions, in addition to the fuses, timing devices, et cetera, that are made by the companies engaged in the manufacture of jeweled watches and the other members of the horological industry.

"And so, generally, as I say, our conclusion is that this entire industry is extremely important—is vital, I would say—to the national defense of this country." (Hearings before Preparedness Subcommittee No. 6 of the Committee on Armed Services, U.S. Senate, 83d Cong., June 30, 1954, p. 40.)

Thus, both the Department of Defense and the 1954 Preparedness Subcommittee have made it abundantly clear that the preservation of the clock and pin-level watch segment of the U.S. horological industry is vital to this country's security—fully as vital as preservation of the jeweled-lever watch segment. Indeed, the proof is in the large and growing amount of defense contract work these companies are engaged in today. In a time of all-out mobilization, the clock and pin-lever watch producers, as they were during World War II and the

Korean conflict, would be called upon to contribute heavily to our Nation's defense arsenal.

I have gone to some lengths to point out the importance to national defense of the clock and pin-lever watch producers partly because I am the only representative of this segment of the industry appearing here today, but primarily because of the existence of a distinct possibility that another branch of our Government is presently considering making further cuts in the tariffs applicable to imports of foreign-made clocks and pin-lever watches.

Since, unlike jeweled watches, clocks and pin-lever watches were not accorded escape-clause relief in 1954, they are not a part of the current Tariff Commission investigation to which General Bradley has referred. Accordingly, the separate rates of duty which are applicable to imports of clocks and pin-lever watches are even now subject to further reductions in the Kennedy round of GATT negotiations.

I do not need to remind the committee that the rates of duty applicable to clocks imports were cut 50 percent in 1951. Since that time foreign-made clock imports have increased from a 1951 total of 693,537 units to approximately 4,700,000 units in 1963. The Tariff Commission reports that imports of pin-lever watches have increased in like manner, and we know from our own experience that it is no longer profitable to manufacture pin-lever wristwatches in the United States.

Of course, it is not the purpose of this committee to inquire into such matters as tariffs, imports, and the like, but I did want to inform this committee of the danger from further tariff cuts that we are presently facing. Against this background, I would like to review briefly what has happened to the producers of clocks and pin-lever watches since the 1954 study.

Since the Preparedness Subcommittee conducted its investigation in 1954, U.S. clock and pin-lever watch manufacturing has gone steadily downhill under the crushing impact of increased foreign imports. Today, only General Time and the Ingraham Co. manufacture complete pin-lever watches in the United States—and those are only pocket watches, which have not to date met a high degree of import competition. New Haven Clock & Watch Co. went out of business in 1959. Also in 1959, the Ingraham Co. abandoned wristwatch production. General Time finally ceased its U.S. production of wristwatch parts this year.

In 1954, there were eight companies manufacturing spring-driven clocks in the United States. Today, there are only four—Westclox Division of General Time, Lux Time Division of Robertshaw Controls Co., the Ingraham Co., and the General-Gilbert Corp. New Haven Clock & Watch Co. and Chelsea Clock Co. have gone out of business. The Seth Thomas Division of General Time has ceased domestic production altogether and is importing all of its clocks.

The now defunct clock and watch manufacturing companies were important contributors to this Nation's defense during World War II and the Korean conflict. Their capacity for producing precision ordnance instruments is now lost forever. The remaining companies are being compelled step by step to cut back domestic production and resort more and more to importing foreign-produced timepieces. Indeed, I believe it can be accurately stated that the U.S. clock and watch producers today have less than half of the defense production capability that they had at the time of the Korean conflict, and even then we had to buy many millions of parts from Switzerland in order to meet our production commitments.

If the United States is, as Sir Stafford Cripps put it to a sadder and wiser British Parliament in 1945, to avoid "the risks which are inseparable * * * from dependence on oversea sources" for critical defense items, which the clock and watch industry is uniquely capable of producing on short notice and in large volume, the remaining U.S. production of timepieces and related mechanisms must be protected from ruinous low-wage, cartelized, and subsidized, foreign competition.

It is in the capacity to engineer, and to convert speedily to the quantity production of, critical military and items that the clock and watch industry excels. Years of careful training and planning and design experience in peacetime production have produced this complex of industrial resources, and many more years will be required to regain it if it is once lost.

This industry is uniquely qualified to manufacture, in large volume, the wide variety of timing devices required by our military forces. The mechanical time fuse, for example, has been largely developed and produced by the clock and watch industry. While the mechanical fuse has been replaced for some special purposes by the proximity fuse, the safety and arming portion of the proximity fuse is still mechanical. Fuses are only one example. This industry designs and produces many complex military and space-exploration timing mechanisms and control devices.

As you are well aware, our Nation's defense arsenal has become increasingly sophisticated since 1954 and is becoming more so each day. As weapons sophistication progresses, so does the need for more precise, miniaturized and rugged timing and control mechanisms. The military has been turning increasingly to the clock and watch industry for the design, development, and the production of these new, sophisticated devices.

At the same time, the military has continued to rely heavily on this industry's proven capability to produce fuses and fuse parts in large volume and on short notice. For example, General Time was called upon last year to produce a large volume of XM–548 fuses for Army Ordnance. Utilizing its then-operating pin-lever wristwatch facilities, at its Westclox division in La Salle, Ill., General Time was able to convert quickly to the mass production of these fuses. It should be noted that these same facilities which, in the past, have been large volume producers of pin-lever wristwatches, are the ones which General Time has had to close down this year because of import competition.

Another example is the Navy's mine program. The timing devices required by this program were designed and developed during the Korean crisis. General Time's Seth Thomas division was the only producer in the country able to develop and produce these devices successfully. Several other companies had tried without success. Seth Thomas is still producing these devices for the Navy's Bureau of Weapons.

A list of some of General Time's recent and current contracts for the development and production of military and defense-related items is being submitted as an appendix to this statement. I believe it shows beyond any doubt that General Time is making a vital contribution to our country's regular defense needs and that a strong, healthy clock and pin-lever watch industry would be absolutely essential to the Nation's security in a time of crisis.

I just want to point out briefly that while there are doubtless many manufacturing establishments outside the horological industry which, given ample time, money, and design blueprints, are quite capable of producing military devices and instruments like those produced by this industry, I sincerely believe that the United States will be taking a serious military risk if the impetus toward free trade is allowed to destroy domestic clock and watch production.

Adam Smith himself stated that "defense is more important than opulence." And what could be better evidence of the defense essentiality of a healthy national horological industry than the bitter experience of the United Kingdom during World War II, when she had allowed her horological industry to be decimated by subsidized German production and had to depend upon the United States for military timing devices.

The lesson learned by the British in World War II is daily taking on more significance as modern weaponry becomes more sophisticated. The rapid and deliberate expansion of the Russian timepiece industry in an economy not distinguished by its output of consumer goods should constitute ample warning to U.S. policymakers. Increased U.S. dependence upon Swiss, German, and Japanese timepieces would severely impair this country's ability to produce the mechanical timekeeping and controlling devices so essential to modern military operations and, accordingly, would undermine our country's military posture.

General Time Corp., Defense and Space Programs, 1962–64

SAFETY AND ARMING DEVICES

Army

General Time's Skokie facility has worked as a subcontractor for Convair, Pomona, for the development of a safety and arming device for the Mauler program. This device is in its final evaluation prior to release for limited production.

Navy

The Skokie facility has worked as a subcontractor for Goodyear for the development of the timing mechanism for the safety and arming device used on the Subroc program.

For the Navy Bureau of Weapons, as a subcontractor for Martin, we designed and produced the safe-distance arming device for the Bullpup missile.

Air Force

General Time developed and produced an electromechanical separation switch, as a subcontractor for General Electric, Philadelphia, for use on the Titan II missile.

As a subcontractor for General Electric in Burlington, the Skokie facility produced an electromechanical programer for the Titan missile for use on the reentry vehicle.

FUZES

Army

Mark 548 fuze.—This mechanical time fuze has been in volume production at the General Time Westclox facility for the past 2 years and General Time and Ingraham Clock Co. are the only two companies in the United States presently capable of producing this type of fuze on a volume basis.

XM–565.—This is an improved version of the XM–548 which, with the cooperation of Picatinny and Frankford Arsenals, was developed and put into production by our Westclox facility. The development work done by the General Time engineers has substantially improved the timing characteristics and the reliability of the fuze which is widely used by the Army on their various rounds of ammunition.

XM–558.—This is another modified design of the XM–548 which increases the timing of the fuze from 60 to 135 seconds. It is also designed to withstand Hi-g and setback.

XM–563.—The XM–563 nuzzle action is in its final stage of development at General Time and is urgently needed by the Army for special-purpose ammunition. Because of the years of experience and technical know-how in this type of fuzing, our engineers have been able to shorten the leadtime from development to production by about 9 months.

Picatinny and Frankford Arsenals and the Ammunition Command at Joliet, Ill., have worked very closely with the Westclox and Skokie facilities of General Time in the development and production of the above items.

Navy

The Mark 188 fuze was developed and has been satisfactorily produced for the past several years by General Time as a base fuze for the Zuni rocket. The Mark 191 fuze was also developed and is being produced by General Time and is used as a nose fuze on the Zuni rocket. The basic development of the timing device for this is the result of 10 years of work done by General Time engineers on the Mickey Mouse fuze used by the Navy during Korea.

Mark 3 mode 2 is a base fuze used on the Sidewinder missile and was a joint development of General Time and NOL White Oaks Laboratory, and is currently in production at our Westclox facility. General Time also has an engineering contract through NATO to assist Les Forges de Zeebrugge in getting into production on this Sidewinder fuze.

Rockeye I bomb fuze was developed by General Time for use on the Navy rocket and is in limited production.

Air Force

Blu 7 fuze.—For the past 3 years General Time has been working very closely with Army Ordnance in the development of this fuze for the Air Force's use and our Westclox facility has received its first production contract for the complete fuze.

ESCAPEMENT AND CLOCK MOVEMENTS

Army

Blue 3 escapement.—General Time, as the original subcontractor to Aerojet-General, has been the largest producer of this escapement for the Army, having produced over 5 million of them during the past 2 years.

The No. 66 clock movement, which is a development of the General Time Westclox facility, has been furnished for use by the Navy and the Army to the General Instrument Corp. and Automation Dynamics for an undisclosed application.

Special gear and assembly equipment has been furnished to the Maxson Electronic Corp., who are prime contractors to the Navy Bureau of Weapons, on a subcontract basis.

Our Westclox facility in the past few years has furnished over 30 million fuse and timing parts to subcontractors of the Army and the Navy; such as Day & Zimmerman, Inc., Whirlpool Co., Minneapolis-Honeywell, Raymond Engineering, and quantities to the manufacturers who were performing Government work.

NASA

As a prime contractor to NASA, we designed and developed an encoder clock on IMP.

TIMERS AND PROGRAMERS

Army

General Time has worked with the Harry Diamond Laboratory (formerly Diamond Ordnance Fuze Laboratory) in the development of a 3-minute timer for the Army's use on a mine program which is in its final stage of evaluation.

As a subcontractor to Beckman & Hughes Aircraft, we designed and developed programers for JPL Army Ordnance for use on the Surveyor and Syncom programs.

Air Force

For the past 2 years as a subcontractor to Avco, our Skokie facility has been involved in the development and production of 5-second, 10-second, and 30-second timers for use in connection with Minuteman and Titan missile programs.

AEC

For Sandia, our Westclox facility has been furnishing our T–3 mechanical timer which was developed by GT.

Navy

General Time at our Stromberg (Seth Thomas) facility is currently in production on the CD–12 clock delay mechanism and the Mark 10 and Mark 19 actuator counters. These items were developed by General Time in conjunction with the Navy Ordnance Laboratory, White Oaks, Md., and are considered critical components in the Navy Mark 39 mine fuse program. General has been involved in this program for the past 10 years, and has been the only successful producer of this item for the Navy Bureau of Weapons.

For the Navy Bureau of Weapons, as a subcontractor to NOTS, we designed and developed an electronic frequency divider for the TV camera for use on the Walleye.

NASA

For NASA, our electronic systems division, as a subcontractor to RCA, has developed an electronic programer on the Tiros program. This programer, which programs the taking of pictures in the satellite, has over 300,000 system hours of proven performance.

For NASA, we, as a subcontractor to McDonnell, designed and manufactured electronic programers for the Gemini space vehicle.

STATEMENT OF WESLEY A. SONGER, PRESIDENT, INGRAHAM CO.

THE INGRAHAM CO.,
Bristol, Conn., August 14, 1964.

Subject: Essentiality of the domestic clock and watch industry to our national defense.

SPECIAL SUBCOMMITTEE,
ARMED SERVICES COMMITTEE,
U.S. Senate.

GENTLEMEN: My name is Wesley A. Songer. I am president of Ingraham Co., which company manufactures clocks and timing devices in operating divisions located in Bristol, Conn.; Laurinburg, N.C.; and Elizabethtown, Ky.

I am submitting this statement to you in support of this subject and with the sincere hope that it will receive your careful consideration.

Since the day over 50 years ago when Gebruder Junghans, of Schromberg, Germany, developed the concept of a mechanical time fuse the major powers of the world have carefully nurtured their capabilities in the volume production of timing devices—or have failed to do so at their peril.

Let me briefly review some historical evidence of this with which I am sure you are familiar.

During the period between 1935 and the outbreak of World War II, Germany heavily subsidized the export of timepieces to France and England with the now obvious intention of destroying the timepiece industry of those two countries. The fact that Germany succeeded in her designs is attested to by statements made in the House of Commons by Sir Stafford Cripps on October 16, 1945. Consider his words:

"The inadequacy of the clock and watch industry left a very serious gap in what might be termed our industrial armory."

He further stated that for very important military timing elements they were "dependent on oversea sources and should have had a reservoir from which we could have drawn machine tools, skilled labor, and management well suited to the manufacture of many of those precision instruments upon which war so much depends today." As a result of his lengthy report to Commons, seven steps were taken to overcome this situation:

1. Quotas were placed on the importation of clocks and watches.
2. Import duties were increased substantially so as to hold down imports when quotas might be lifted, but they haven't been lifted yet.
3. A buy-British policy was adopted on clocks and watches.
4. The Empire's preferential for her colonies was maintained and has still been maintained in the fact of our State Department's pressure.
5. The Government established "a National College for Clock and Watch Manufacture."
6. The Government leased plants to clock and watch manufacturers on easy rental terms and on a basis where the firm were relieved of depreciation for the duration of the lease.
7. The Government saw to it that the finest of equipment was secured from Switzerland together with trained employees capable of operating said equipment.

Here is an example of the "cold war" and "we will bury you" type strategy in operation long before those two phrases were coined.

Since World War II the British having been once burned have taken care to see to it that henceforth they would "avoid the risks—from dependence on oversea sources."

Soviet Russia since the late 1940's has taken aggressive steps to create a domestic horological industry. There is no basis for assuming a sudden concern in the Kremlin for the consumers' demands in the Soviet economy. Commonsense dictates that this represents evidence of a Soviet realization of the essentiality of a sound horological industry to her defense efforts.

The timepiece industry in Japan in recent years has assumed "boom" proportions. Is it not unreasonable to assume that the Japanese have read their history carefully as have other major combatants of World War II.

Some might ask, "Is this industry as essential now—in a nuclear age—as it was during World War II?"

Gentlemen, in our opinion it is, if anything, more essential now than ever. As our weaponry has become more sophisticated there has developed a need for the paralled sophistication of the devices which control the timing of these items.

In the field of artillery ammunition alone ballistic forces are being encountered which were unheard of 10 years ago. In addition the lethality of this ammunition has made imperative the highest degree of precision in the timing area.

We would also ask that you review the attached appendix A which outlines the considerable defense activity in which we have been engaged since the Korean war. This, of course, represents the activity of only one firm in the clock and watch industry. We would also point out that the activities of others such as Bulova, Elgin, Hamilton, and General Time, to name a few, have likewise been extensive and impressive.

The clock and watch industry has no purpose whatever to exaggerate or overstate its importance to this country's potentialities for industrial mobilization. But we are keenly aware of the fact that the industry is expected to perform an important function in the present program of defense production, and a vastly more important function in the event of all-out war. We know, too, that it is not the policy of the armed services to expose the United States to "the risks which are inseparable * * * from dependence on overseas sources," as Sir Stafford Cripps described it. Yet this country will inevitably be exposed to exactly those risks if it continues to permit the progressive destruction of the domestic watch and clock industry through unlimited competition from abroad.

WESLEY A. SONGER, *President.*

INGRAHAM CO. MILITARY PROJECTS SUMMARY

1. M–500A1, mechanical time, superquick fuze—1951–54

Supply contract. Engineereing development items encountered during production include the following:

(*a*) Development of a gaging method for classification of levers and mating with proper escape wheels.

(*b*) Improved method for removal of backlash from gear train.

2. M–125 booster—1955–63

Supply contract. Delay arming booster for standard artillery ammunition. During the course of the contracts, the Ingraham Co. conducted an improvement program to provide better reliability. As a result of this study, the following revisions were incorporated and have been included in subsequent supply contracts:

(*a*) Pin lever type escapement replaced a more expensive assembly which included blanked and screw machine assemblies.

(*b*) Two booster plates were eliminated and replaced by a one-piece plate.

(*c*) Pinion pivots were increased in diameter for added strength.

3. T–787 bomb fuze—1957–59

Engineering development contract. Diamond Ordnance Fuze Laboratories. This contract required development work on an existing unit which was designed about an Ingraham Co. wrist watch movement. The basic problem was to improve the shock resistance of the movement and to assure the reliability and timing of the unit.

4. 1224 mine fuze—1958–59

Engineering development contract. Diamond Ordnance Fuze Laboratories. This contract involved adaption of the same movement used in the T–787 fuze for a mine fuze.

5. T–908 bomb fuze—1958–59

Engineering development contract. Diamond Ordnance Fuze Laboratories. This contract required incorporation of the same gear train and escapement assemblies as used in the T–787 movement into a new movement with an increased delay time. Additional problems arose in this unit due to increased mainspring torque and additional stages in the gear train.

6. T–367 mechanical time fuze—1960–61

Limited production contract—2,500 units. Frankford Arsenal.

7. T–197 and T–275 fuzes—1960–62

Limited production; T–197, 2,400 units; T–275, 1,400 units; Frankford Arsenal. During the course of the contract, the following problems were encountered and solved as indicated:

(*a*) Waterproofness improved by use of Silastic No. 731.

(*b*) Movement stopped during high spin. Solved by using a stronger mainspring, reducing the mass of the firing arm weight and polishing the bearing edge of the firing arm upright.

(*c*) Safety adapters pulled out of fuze bodies during firing. Solved by increasing the diameter of the closing plug and increasing the length of thread on the adapter body.

8. T–369 mechanical time fuze—1959–62

Limited production, 1,100 units, Frankford Arsenal. This unit is a mechanical time fuze with a special muzzle action element. The basic problem area was in the muzzle action element which required considerable engineering effort by the Ingraham Co. and the arsenal to improve the reliability as well as to test out, redesign, and retest the powder train.

9. MK-26, Mod. 1 explosive destructor (Leech)—1960–63

Engineering development and limited production, Naval Underwater Ordnance Station, Newport, R.I. This contract required design, fabrication and test of a time fuze mechanism for demolition work. The unit is designed using Ingraham Co. wristwatch movement parts. This program is still in process.

10. XM-548 and XM-565 fuzes—1960 through present

Supply contract. Mechanical time fuze for artillery ammunition. The major item requiring engineering support on this item is the improvement of timing accuracy and reliability.

11. Timing disc torquing—1958–59

Engineering development, Frankford Arsenal. This contract involved two phases:

(*a*) Develop an automatic spinning machine which would spin the timing disc bushing over the collar and test the torque. If the torque is not high enough, another spin cycle takes place to bring the torque within the proper range. If the torque becomes too high, it is automatically rejected.

(*b*) Phase No. 2 was to develop a method of staking the bushing over the collar which would eliminate the need for spinning. This system was accomplished by using three Belleville washers in series.

12. Automatic zero set—1958–62

Engineering development, Frankford Arsenal. This contract was awarded for the investigation and development of an automatic zero setting device for mechanical time fuzes. After considerable investigation of various methods, it was decided to proceed wtih an electronic automatic zero set unit which operated on a closed circuit video system. This system operated a Servo motor which placed the zero point in position as directed by the sweep circuit. This deisgn has not yet been finalized.

13. XM-565 fuze development contract—1963–64

Engineering development, Frankford Arsenal. This program was designed to improve the performance of the fuze by combined effort of Ingraham and Frankford personnel. Studies, analysis and tests were made which have led to proposed improvements.

14. M-562 mechanical time fuze—1963–64

Supply contract. Production model of T-275 fuze for Army Materiel Command. Contract in initial phases of production.

15. XM-563 mechanical time fuze—1963–64

Limited production and development contract of mechanical time fuze with muzzle action feature.

Senator SYMINGTON. General Bradley, who is your next witness?

General BRADLEY. For our last witness, we have Mr. Henry Margolis, chairman and president of the Elgin Watch Co.

Senator SYMINGTON. Where is your company, Mr. Margolis?

STATEMENT OF HENRY M. MARGOLIS, PRESIDENT AND CHAIRMAN OF THE BOARD, ELGIN NATIONAL WATCH CO.

Mr. MARGOLIS. Elgin, Ill., and Elgin, S.C.

Senator SYMINGTON. Where is your company, Mr. Sinkler?

Mr. SINKLER. Lancaster, Pa.

Senator SYMINGTON. And yours, General Bradley?

General BRADLEY. New York, Long Island.

Senator SYMINGTON. Will you read your prepared statement?

Mr. MARGOLIS. We also have facilities in Gadsden, Ala., and California, as well.

Senator SYMINGTON. If you keep on naming States, I have a suggestion for you.

Mr. MARGOLIS. Let me correct an impression that may have been left by Mr. Lazrus, that we were going out of the military field. That is not true. We are going out of certain military activities, such as communications equipment, certainly not safety devices or elapsed-time indicators, or that sort of thing that is peculiar to our technique.

My name is Henry Margolis. I am president and chairman of the board of Elgin National Watch Co. While my interest in the watch business dates only from 1958 when I first became a shareholder in Elgin and more directly from 1960 when I took office as chairman, I have learned a great deal in that period of the watch industry and its problems.

I have also learned considerable of the capabilities of the watch industry and of Elgin in particular as a supplier of defense materiel for the Government. I have asked Mr. Ensign, an engineer by profession, long associated with Elgin, and intimately familiar with the technical aspects of our defense contributions, to accompany me today and to leave with you a statement he has prepared describing some of the many projects we have undertaken of a military nature. They include the design, development, and manufacture of fuses for Army and Air Force rockets, high explosive and fragmentation bombs, mortar and artillery ammunition; various timers, programers, and safety and arming devices for missiles such as the Atlas, Bullpup, Centaur, Genie, Hawk, Nike, Tartar, Terrier, Shrike, Sidewinder, Sparrow, and Subroc; rockets Green Quail and Pogo-Hi; sattelites; and spacecraft—you heard our friend from NASA this morning—including the design and development of the central timing system for the Apollo and the lunar excursion module and a variety of land and underwater mines; and literally millions of precision-built parts for many other defense contractors.

For my own part, I can state, unequivocally, that this work could not have been performed apart from, or in the absence of, the contemporaneous manufacture of our basic product, jeweled watches, and that similar work cannot be undertaken in the future unless we are able to continue and expand our production of watches in this country. In the first place, it is difficult to program, subject to wide fluctuations in demand both as to product and volume, frequently demanding of special short-term financing, and uncertain as to the costs that will be incurred. This is true generally—not just of the watch industry—though at Elgin we have unfortunately experienced some of these risks at firsthand during the past year. Few companies that I know have been willing to concentrate their production entirely on Government business.

Second, practically every one of the projects described in the list attached to Mr. Ensign's statement as representative of the type of defense work reecntly undertaken at Elgin has involved application of skills acquired and retained because of the company's primary focus upon the manufacture of fine timepieces. For any given project these may be design skills, engineering skills, toolmaking skills, production skills, assembly skills, or some combination of one or more or all of these. They are not easily acquired, and once acquired, can be lost by inactivity or continued concentration upon less exacting assignments. Watchmaking utilizes all of them, in conjunction, and in the highest degree. I know of no way of maintaining all of these skills at necessary levels of proficiency other than by the sustained production of watches.

Gentlemen, watch production at Elgin is in great jeopardy. Our production of watch movements in 1963 was less than 40 percent of our production in 1953. Some 5 years ago we closed our plant in Lincoln, Nebr. We have had to abandon the manufacture of men's movements entirely. We have increasingly become, of necessity, an importer. Last year, roughly half the watches we sold contained imported movements. While we realized a good profit on our imports, we sustained a substantial net loss on our domestic line.

Here, as an aside, I want to reiterate what General Bradley has said.

When we opened our plant in South Carolina, I made a speech saying that we were trying to effect what was a minor crusade. We believed so emphatically that it was sinful to discontinue watch manufacturing in this country, the last 14 percent, which would, by its very consequence, deprive us of these integrated skills. We were attempting in a new form to try to build up that volume.

In a final effort to reverse this trend, we constructed a plant last year in South Carolina where we hope to realize an appreciable laborsaving. The machinery we have installed there is a combination of a modern machinery moved from Elgin and the purchase of the newest machinery available. The plant is intended to be a fully integrated plant for the manufacture of a single movement, a ladies' movement in 17 and 21 jewels. Production at the plant has already reached an advanced stage, though it is not yet fully operational. Precision manufacture of certain parts continues at Elgin, Ill., and we maintain in Elgin a tool and die shop to support production.

Here again, that same 10-year apprenticeship is necessary to get a fully experienced and integrated, as it were, tool and die maker.

It is too early to tell whether we can make a go of it in South Carolina. We are striving mightily to do so. So far, through deliberate personnel planning, we have been able to preserve a hard-core team of key research, key engineering, production and assembly skills—a firm base upon which we can build. But time is fast running out on us. Elgin, you know, is in its centennial year. As a watch manufacturer it has made some outstanding contributions to our national security. As an importer, it will be unable to contribute in kind. The situation we are in is at once as simple and as disturbing as that.

Senator SYMINGTON. Thank you, Mr. Margolis.

Senator Thurmond?

Senator THURMOND. Mr. Margolis, we are delighted to have you in South Carolina with your plant. We hope you can make a go of it. I think I can catch the tenor of the situation, that you have not been able to make a go in some places in this country, even bringing in some of the movements that you are able to purchase overseas cheaper; you realized a good profit on the imports, as I understand, but sustained a substantial loss on your domestic line.

Mr. MARGOLIS. That is correct, sir.

Senator THURMOND. I was interested to see that from 1953 to 1963, your production of watch movements was less than 40 percent.

Mr. MARGOLIS. That is correct, sir.

Senator THURMOND. In other words, your sales have gone down.

Mr. MARGOLIS. Not our sales, but our production has gone down.

Senator THURMOND. Your production has gone down to that extent. You were forced to close your plant in Lincoln, Nebr.?

Mr. MARGOLIS. We were, sir.

Senator THURMOND. You did not want to close that plant, I am sure.

Mr. MARGOLIS. You are quite right.

Senator THURMOND. In other words, you would like to have kept that plant and operated it, because you feel it is good for the country to have these watch plants and, from your own company's standpoint, you would like to operate and make a profit, I presume?

Mr. MARGOLIS. Indeed.

Senator THURMOND. And you have had to abandon the manufacture of men's movements entirely?

Mr. MARGOLIS. That is correct.

Senator THURMOND. Is that in all your plants, or is that just——

Mr. MARGOLIS. Entirely.

Senator THURMOND. That is in all your plants. And you have been forced to become an importer because of the impossibility to compete with the foreign movements being shipped in here?

Mr. MARGOLIS. That is correct. The watches are about 80 percent labor, and the costs abroad for labor are one-third our costs; just one-third.

Senator THURMOND. One-third. Well, you cannot compete with that. The only way to offset that would be to have a tariff high enough, or place a quota on the number that can come in, so that it will not destroy your business entirely, is it not?

Mr. MARGOLIS. That is correct, for all the watch companies left.

Senator THURMOND. I believe that in your company last year you used—about half the watches that you sold contained imported movements?

Mr. MARGOLIS. That is correct, and ours is the lowest percentage of imports for the remaining jeweled watch companies.

Senator THURMOND. Yours is the lowest percent of imported movements?

Mr. MARGOLIS. That is correct.

Senator THURMOND. I can certainly sympathize with you in what you are going through, and it is my hope that the light will dawn some of these days on some of these people who are making policy decisions in our Government.

We are glad to have you here, and I congratulate you on your fine statement.

Thank you, Mr. Chairman.

Senator SYMINGTON. Mr. Margolis, is there any estimate of those 46 million produced movements in Switzerland that are imported into the United States?

Mr. SINKLER. It is less than 10. I think it is about 8 million.

Mr. MARGOLIS. Jeweled, that is. Jeweled-lever watches.

Mr. SINKLER. I think it is 5 million more of the pin-lever. I think we are talking jeweled-lever now.

Senator SYMINGTON. Thank you.

General Bradley, does that complete the presentation?

General BRADLEY. That was the last witness we had suggested, Mr. Chairman. We do have, in addition to Mr. Van Haften, whom you met this morning, Mr. Sites and Mr. Ensign, and we have two other people from Bulova, Mr. Bozzo, who is vice president in charge of manufacturing watches, and Mr. Harry Gewirtz, who is director of our research and development laboratories and our production and defense work. If there are any questions by any members of your staff on any of these exhibits, these gentlemen are all here and will be glad to answer your questions.

In addition to that, we have our executive vice president and general counsel, Mr. Flick, who went through all of the antitrust hearings. In case there are any questions on that, I think he might be able to help you on the record.

Other than that, we have no further matters to suggest.

Senator THURMOND. I have one question.

Senator SYMINGTON. Senator Thurmond.

Senator THURMOND. Mr. Margolis, maybe you can answer that, or General Bradley. How many watch movements are imported into this country annually from all foreign countries?

Mr. MARGOLIS. 13 million.

Mr. SINKLER. Watches of all kinds from all countries, 13 million.

Senator THURMOND. 13 million imported from all foreign countries?

Mr. SINKLER. All foreign countries and all kinds of watches—nonjeweled, jeweled, pin-levers, and jeweled-levers.

Senator THURMOND. Of the 13, how many are jeweled?

Mr. SINKLER. We have had 3 categories, Senator: 8 million jeweled-lever watches, 5 million nonjeweled, pin-lever watches, and then another million jeweled-lever watches that have been brought into the United States from foreign sources via the Virgin Islands. They are now not listed as either domestic or imported, as the Tariff Commission defines it. They are parts that are assembled in the Virgin Islands and reexported into the United States.

Senator SYMINGTON. You talk of the Virgin Islands. Do you mean our Virgin Islands, or the British Virgins?

Mr. SINKLER. Ours.

Senator THURMOND. That is nine——

Mr. SINKLER. Excuse me. I gave you the correct figures first. It was 8 million jeweled, 5 million pin-lever, for a total of 13 million imports.

Senator THURMOND. Let us see, 8 million jeweled——

Mr. SINKLER. 5 million nonjeweled.

Senator THURMOND. 8 million jeweled, 5 million nonjeweled?

Mr. SINKLER. Yes.

Senator THURMOND. That is 13.

Mr. SINKLER. And the balance——

Senator THURMOND. That would be 13 million. You said there were 25?

Mr. SINKLER. 13 million. Total U.S. consumption goes to about 25 or 26. We'll file these exactly, Senator, but the gap between 13 and 25 is made up of over a million watches through the Virgin Islands which are not categorized as being either domestic or import, and most of the rest is production of United States Time which is in question, because that is an assembly operation where about 55 percent of the parts are imported, 45 percent are domestic and they are assembled here.

Senator THURMOND. These from the Virgin Islands are jeweled and nonjeweled, are they?

Mr. SINKLER. They are almost entirely jeweled.

Senator THURMOND. When you get that up, if you send me a copy of that, I would like to have it. I would like to have a breakdown from each country.

Mr. SINKLER. Yes, sir; we shall file that with you.

General BRADLEY. I take it the committee is familiar with the Virgin Islands situation, where, when the Congress passed the law, they allowed for the import of movements from the Virgin Islands under certain conditions. About 5 years ago, imports were something like 5,000, I guess, and last year, they were more than 1 million. Most of the companies here have had to go down there for self-protection. We do not have to do too much on them. It is a rather legal question. If you would like to have it, we can file that statement.

Senator SYMINGTON. We can accept that if you would like to file it. Of course it is not a question of tarriffs with this committee.

General BRADLEY. We can put a statement into the record.

Senator SYMINGTON. Would you do that?

If Senator Thurmond approves, and I am sure he will, when you file the record for each country, Mr. Sinkler, would you also get up the estimated average hourly rates for each country?

Mr. SINKLER. I think we can probably do it for all of them except Russia, sir. Of course, no Russian watches are coming in, so they would not appear on the list.

Senator SYMINGTON. I imagine there is not much argument over there as to what the right rate should be.

Is Mr. Lazrus still here?

(The above information is given in app. II beginning on p. 270.)

Mr. LAZRUS. Yes, sir.

Senator SYMINGTON. I was impressed with your statement. Is there anything you would like to say at this time, or file for the record?

Mr. LAZRUS. I think there may be some things, sir, that I would like a chance to think over, a couple of things, and to indicate to you, if we may, in a later filing for the record. [App. I.]

Senator SYMINGTON. Fine. We want to be sure we have been fair to all persons in this matter. If you will get in touch with Mr. Braswell, we shall be glad to file for the record any addition to anything you said.

Senator SYMINGTON. General Bradley, anything else?

General BRADLEY. No, sir.

Senator SYMINGTON. Thank you all very much for coming down. This has been an interesting hearing.

(Whereupon, at 3:30 p.m. the committee was adjourned, to reconvene subject to call of the Chair.)

APPENDIX I

MATERIAL SUBMITTED SUBSEQUENT TO HEARING ON BEHALF OF AMERICAN WATCH ASSOCIATION

BENRUS WATCH CO., INC.,
OFFICE OF THE PRESIDENT,
New York, N.Y., August 19, 1964.

Hon. STUART SYMINGTON,
Chairman, Special Subcommittee,
Senate Armed Services Committee,
Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: At the close of the August 17 hearings on the alleged "defense essentiality" of the watch industry, you invited me to submit any additional comments or materials on behalf of the American Watch Association.

During my prepared testimony, the subcommittee accepted my suggestion that it incorporate in its printed record of the hearings (1) the Office of Defense Mobilization's 1958 decision that the domestic watch industry was not essential to the national security, together with the supporting letters, memorandums, and reports filed with ODM by agencies and individuals consulted in the course of the investigation and (2) a packet of charts and statistics submitted by the American Watch Association in recent testimony before the U.S. Tariff Commission to show that the domestic industry is not being injured nor threatened with injury because of import competition. These materials are attached. (Please note below my request that the charts and statistics be incorporated in the printed record following a statement regarding the economic condition of the domestic watch industry which I am also submitting.)

Because uncritical acceptance of mere claims of defense essentiality could dangerously undermine U.S. foreign economic policy and because this was the central issue of the 1956 study of the Joint Economic Committee, to which I referred in my statement, I also request that the Joint Economic Committee's report be incorporated in the printed hearings record of the Armed Services Subcommittee. Although it is true that the Joint Economic Committee's report, unlike the ODM report, is available elsewhere, we feel that it is important to provide a full background in the hearing record of this subcommittee.

Finally, because it is obvious that a number of subcommittee members have accepted the domestic watch industry's claim that it is in fact threatened with injury from import competition, I am also submitting for inclusion in the record portions of three statements made on behalf of the American Watch Association at recent hearings before the U.S. Tariff Commission.

Mr. Myer Rashish, a consulting economist, of Washington, D.C., demonstrated in May, conclusively, I think, that the domestic watch industry has substantially improved its economic position during the past decade and that, far from being injured by duty reductions, domestic producers would actually be benefited in several important respects by the withdrawal of tariff increases imposed by Presidential decree in 1954. Mr. Rashish also demonstrated that domestic producers are fully equipped to cope in the future with any intensification of import competition.

Thus, even if the domestic watch industry is, contrary to the flat conclusions of Government authorities, regarded as essential to national security, there is no factual basis for the claims that the industry is threatened by import competition. Domestic producers will continue, whatever happens to the tariff, to be in a position to make a contribution to U.S. national security. (I would suggest that the charts and statistics which we are submitting and which are referred to earlier in this letter should appear in the record immediately following the excerpt from Mr. Rashish's testimony, since he refers to these figures in his remarks.)

The claims of certain domestic jeweled-lever producers regarding the economic position of the industry are based on statistical juggling which they seek to justify by an extraordinary and totally fallacious notion of what constitutes the domestic watch industry. My testimony to the Tariff Commission of July 29, 1964, discussed the attempt by these jeweled-lever companies to rule the United States Time Corp. entirely out of the picture. Testimony by Mr. M. Fred Cartoun, president of the American Watch Association, also delivered at the July 29 hearing, effectively summarizes developments in the U.S. watch market during the last decade and exposes the misstatements and misconceptions on which the case of the jeweled-lever producers depends.

I would appreciate if these excerpts from statements by Mr. Rashish, Mr. Cartoun, and myself could also be incorporated in the record.

Thank you for your courtesy.

Sincerely,

JULIAN LAZRUS.

Enclosures:

Office of Defense Mobilization:
- Gordon Gray letter, February 28, 1958.
- George B. Beitzel report, September 25, 1957.
- C. Leigh Stevens report, June 5, 1957.

Defense Department: Quarles letter and tabs A through J.

Labor Department:
- Siciliano letter, August 2, 1957.
- Staff report, August 1957.

Senate Report No. 2629 (84th Cong. 2d sess.):
- Joint Economic Committee report.
- Defense Essentiality and Foreign Economic Policy Case Study: Watch Industry and Precision Skills.

Statements of:
- Mr. Myer Rashish, May 12, 1964 (with charts and statistics submitted by AWA, May 12, 1964).
- Mr. Julian Lazrus, July 29, 1964.
- Mr. M. Fred Cartoun, July 29, 1964.

EXECUTIVE OFFICE OF THE PRESIDENT, OFFICE OF DEFENSE MOBILIZATION, WASHINGTON, D.C.

Gordon Gray, Director of Defense Mobilization, announced today his conclusion that imports of jeweled and pin-lever watches and clocks are not threatening to impair the national security.

Mr. Gray stated this conclusion in a letter to two trade associations representing the domestic horological industry, and to the Bulova Watch Co. It was based, he said, on his evaluation of the facts developed during an exhaustive investigation of the relationship of the domestic horological industry to military and essential civilian requirements in a future emergency.

He pointed out that in the years intervening since 1954, when this subject was last officially reported on by the Office of Defense Mobilization, not only has a marked reduction in mobilization requirements taken place, but a substantial expansion of precision skills and plant capabilities has become incorporated in our industrial economy.

The associations had filed petitions with ODM under section 7 of the Trade Agreements extension Act asking Mr. Gray to determine whether imports were either a threat to or a continuing impairment of national security.

Mr. Gray's letter, sent to the American Watch Manufacturers Association, Inc., is attached. Identical letters were sent to the Bulova Watch Co., and to the Clock & Watch Manufacturers Association of America, Inc.

EXECUTIVE OFFICE OF THE PRESIDENT,
OFFICE OF DEFENSE MOBILIZATION,
Washington, D.C., February 28, 1958.

MR. PAUL MICKEY,
Vice President, American Watch Manufacturers Association, Inc.,
Washington, D.C.

DEAR MR. MICKEY: On December 26, 1955, the American Watch Manufacturers Association, Inc., and the Bulova Watch Co. jointly requested the Office of Defense Mobilization to "initiate immediate action under section 7 of the Trade Agreements Extension Act of 1955 (Public Law 86, 84th Cong.) to remove a continuing impairment to the national security." On April 18, 1956, the Clock & Watch Manufacturers Association of America, Inc., filed a similar petition. Inasmuch as both the jeweled and pin-lever segments of the horological industry have produced a variety of essential timing and other devices used by the military and the civilian economy, it was decided to consider and answer these petitions for the horological industry as a whole. Accordingly, this letter replies to the two "Section 7" petitions.

It should be borne in mind that, in conformity with the responsibilities of the Director of the Office of Defense Mobilization fixed by law, this study has been directed solely to the national security aspects of this problem.

The Office of Defense Mobilization responded to the above-mentioned filings by causing an exhaustive investigation to be undertaken, which included:

1. A review by the Department of Defense of all contracts it awarded to horological firms for the years 1951 through June 1957.

2. Estimates of mobilization requirements in the horological field made by the Department of Defense and the Department of Commerce.

3. The appointment of a consultant to undertake and coordinate an examination of the jeweled watch segment of the horological industry. A consulting engineer was appointed to assist with engineering advice;

4. The holding of public hearings;

5. Surveys, visits and discussions by Department of Defense teams with manufacturers of 26 missiles; 37 nonhorological firms with capacity for producing safety and arming devices; domestic jeweled-watch plants; clock and pin-lever watch plants; key manufacturers of missile guidance systems; technical laboratories of the Defense Department; and an installation of the Atomic Energy Commission;

6. Studies of pertinent skills by the Department of Labor in several domestic jeweled-watch plants; one importer jeweled-watch assembly plant; several clock and pin-lever watch plants; and a number of precision manufacturing plants outside of the horological industry.

7. A review by the interagency Advisory Committee on the Watch Industry of the data developed.

An account follows of the principal actions taken and facts and data developed.

ORDER BOARD REVIEW

The Defense Department reviewed the order boards of all domestic horological firms, covering prime contracts, subcontracts, research and development, and parts supply from 1951 through June of 1957. This review was necessary in order to measure the volume of horological products produced for military needs as well as to identify the items for which an alternate source of supply would be needed if they were not produced by the horological industry. The review also developed data useful in the preparation of requirements estimates. These data were made available to the Department of Commerce, the Department of Labor, and to this Office.

REQUIREMENTS

Studies by the Department of Defense indicate that new weapons and changed concepts have greatly reduced current military mobilization requirements for jeweled timepieces and timing devices. As an indication of the reduction which has taken place, military requirements reported as of December 1956 for jeweled watches and chronometers were drastically reduced from World War II requirements; and were down to about one-half of 1954 estimated requirements.

The most recent Department of Defense estimate, based on the latest strategic concepts, indicates a further reduction in volume in military requirements since December 1956 of as much as 75 percent in those timing devices which have been major items of military production by the horological industry. Mobilization requirements for watches and clocks have also declined since the December 1956 estimates.

A Department of Commerce estimate of essential civilian requirements for jeweled watches as of December 1956 was based largely on World War II experience here and abroad, on specialized civilian and industrial needs and on annual market sales volume. A more recent review indicates a reduction in specialized needs.

Civilian and industrial requirements for watches exceed the military requirements but there are tens of millions of watches and clocks in use by individuals in the United States and several millions more in trade channel inventories that could be available for essential needs in an emergency.

PUBLIC HEARINGS

At hearings held on January 7, 8, and 9, 1957, 28 witnesses were heard. The hearings were conducted in an informal manner. Every aspect of the question of the essentiality or nonessentiality of the horological industry to the national security that parties at interest, outside of the Government, wished to present was included in the record.

CAPACITY AVAILABLE IN MOBILIZATION

The Department of Defense has programed and assigned to individual firms certain military production which is to be undertaken should an emergency arise. The production of a portion of safety and arming and other timing devices has been assigned to horological firms. A study was made to determine (*a*) the items together with the volume planned for production in an emergency by the horological industry, (*b*) the scope of planning with plants outside of the horological industry which had the capability to make the items referred to above, and (*c*) the capacity of nonhorological firms to produce safety and arming devices. Surveys of 37 selected nonhorological firms revealed both the capability and capacity to design and manufacture far in excess of the volume of orders assigned to horological firms without disturbing the production of other military items already planned for the particular firms.

RELATIONSHIP TO THE MISSILE PROGRAM

In the surveys of missile plants by the Department of Defense teams, particular attention was directed toward the kind of precision operations being conducted, as well as to parts or components procured by the missile manufacturers from horological firms. Specific inquiry was made of both the technical and executive level and especially of the procurement, production, and design engineers to determine if there were items or components used in missiles upon which it was felt reliance must be placed on the horological industry to produce. The purpose of the survey was first explained to the executive management, after which the engineering staff was interviewed. A second meeting with the executive group was then held in order to obtain confirmation of the engineers' report as to the experience of the firm in the use of horological industry firms and other sources of manufacture.

The Department of Defense reported that many of the officials and engineers interviewed had been with missile projects during the period of research and development and many of the missiles studied were in various stages of development. No missile manufacturer questioned indicated a dependence upon the horological industry either for production or research.

The director of guided missiles stated that, "Viewed solely from the standpoint of the potential contribution to the guided-missile programs, it is evident that the horological industry cannot be considered to be essential to these programs. To the extent the facilities of the horological industry are available to us, we shall continue to utilize them in competition with other qualified producers in nonhorological industries."

SURVEYS BY DEPARTMENT OF DEFENSE TEAMS OF TECHNICAL LABORATORIES

Safety and arming devices represent the largest volume in terms of either dollars or units which horological firms produce for use in missiles. The service laboratories having technical responsibility for safety and arming devices reported that many firms outside the horological industry have the capability and capacity to design and manufacture these complex items and are presently doing so.

SURVEYS BY DEPARTMENT OF DEFENSE TEAMS OF HOROLOGICAL FIRMS

These inspections were made in order to observe the manufacturing processes in the various plants, with special emphasis on an examination of the firms' research and development capabilities. While operations in this field reflecting real credit on the industry were noted, there did not appear to be an unusual research or development capability that could not be found elsewhere. This view was shared by the Assistant Secretary of Defense for Research and Engineering.

STUDIES BY LABOR DEPARTMENT TEAMS

In the studies conducted in various plants by the teams of the Department of Labor, an examination was made of nine skills agreed upon by the jeweled-lever industry as being representative of key skills in the industry to determine the characteristics and employment of such skills and to obtain information as to the training period required to reach proficiency. Examination was also made of the skills in a number of pin-lever and nonhorological precision plants in order to determine if similar skills were to be found in such plants, and the length of time required to reach proficiency upon transfer from one group to the other. The wartime requirements for jeweled-lever industry skills were estimated on the basis of the production programs provided by the Department of Defense.

The Department of Labor investigation showed that in most of the skills examined, with a brief training period, there was relative ease of interchangeability between the jeweled and pin-lever segments of the horological industry, and with training periods of varying lengths, there could be some interchangeability of key skills between precision manufacturers outside the horological industry and those within the horological industry.

CONSULTANT'S REPORTS

The consultant referred to above read and considered all evidence presented up to September 25, 1957, the date of this report. In the process of his investigation he visited the plants of the domestic jeweled watch manufacturers, observed the operations of a number of importers, and also spent several days visiting jeweled watch plants in Switzerland. While he did not have the benefit of data developed by investigations made in recent months by the Department of Defense, his conclusion reads as follows:

"It is desirable to have a jeweled watch industry in being in this country for the contribution it can make, along with other precision manufacturers, for production of the timing devices and other items needed by civilian and military users both in peacetime and in emergencies. However, due to significant reductions in recent years in the mobilization requirements for jeweled movements, the tremendous advances in and diffusion of precision production techniques and the availability of necessary skills and production capacity, there does not appear to be a threat to the national security because of imports of jeweled watch movements."

The engineering consultant, after visits to horological plants, to precision manufacturers outside the horological industry, and to a number of missile plants, reported in June 1957 that he had identified four items for military use which he believed only the jeweled watch industry could produce. Based on this belief and his study of the subject from an engineering and organization standpoint, he concluded that the jeweled watch industry was essential to national defense.

Investigation later made by the Department of Defense established that three of these items were then being produced outside of the horological industry and the fourth had been found unsuitable for use in the missile complex in which it had been expected it could be beneficially incorporated.

CHANGES IN TECHNOLOGY

In the years intervening since 1954 when this subject was last officially reported on by this agency, a substantial expansion of precision skills and plant capabilities has become incorporated in our industrial economy. This trend was developing rapidly by 1954 but had not reached its present degree of maturity and application. These skills and capabilities may now be found in many industries with a consequent enlargement of the base in precision production.

SUMMARY

1. On the basis of the studies it has conducted, the Department of Defense has concluded that the horological industry is not essential in the supply of items critically needed by the military in times of national emergency.

2. It is the opinion of the Department of Commerce, after giving consideration to all factors, that essential civilian requirements for high precision jeweled timepieces during a national emergency could be met from domestic production that would be available, from inventories of such movements that are constantly

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widespread throughout distributive channels, and such imports as may be possible from foreign sources.

3. The mobilization requirements for watches and clocks have markedly decreased.

4. New weapons and new strategic concepts have drastically reduced the requirements for the types of military items in the production of which the horological industry has participated.

5. The base for precision production and skills in our industrial economy has expanded substantially.

6. The interagency Advisory Committee on the Watch Industry is of the opinion that the level of imports of horological products does not threaten to impair the national security.

CONCLUSION

I have examined the report of the Department of Defense on this subject transmitted to me by the Deputy Secretary of Defense, the report made by the Department of Labor, the report of the consultant appointed to undertake and coordinate an examination of the jeweled watch segment of the horological industry and the report of the engineering consultant. I have also considered the requirements data submitted by the Department of Defense and the Department of Commerce, the evidence presented at public hearings and the briefs and statements subsequently filed. In addition I have had the benefit of opinions of a number of individuals knowledgeable in this field and have considered the advice of the interagency Advisory Committee on the Watch Industry.

On the basis of the evidence developed by the study, I am unable to find there is reason to believe that the level of imports of horological products threatens to impair the national security.

Sincerely yours,

GORDON GRAY, *Director*.

REPORT ON THE ESSENTIALITY TO NATIONAL SECURITY OF THE U.S. JEWELED WATCH MANUFACTURING INDUSTRY BY GEO. B. BEITZEL

In enacting the Trade Agreements Extension Act of 1955 (Public Law 86) the Congress added a new subsection which reads as follows:

"SEC. 7. (b) In order to further the policy and purpose of this section, whenever the Director of the Office of Defense Mobilization has reason to believe that any article is being imported into the United States in such quantities as to threaten to impair the national security, he shall so advise the President, and if the President agrees that there is reason for such belief, the President shall cause an immediate investigation to be made to determine the facts. If, on the basis of such investigation, and report to him of the findings and recommendations made in connection therewith, the President finds that the article is being imported into the United States in such quantities as to threaten to impair the national security, he shall take such action as he deems necessary to adjust the imports of such article to a level that will not threaten to impair the national security."

On December 29, 1955, the domestic jeweled-lever watch industry petitioned the Director of the Office of Defense Mobilization to initiate action under this section of the act to relieve what was felt by the petitioners to be a threat to the national security created by the importation of watch movements into the United States.

On March 27, 1956, I was appointed as an ODM consultant on the watch industry, my duties to consist of advising the Director on the question of essentiality to the national security of the U.S. jeweled watch manufacturing industry.

BACKGROUND

In 1952, because of a sharp decline in the manufacture of jeweled watch movements, President Truman ordered a study of the industry to determine whether loss and deterioration of highly developed watchmaking skills were likely to imperil the security of the United States in the event of a national emergency. On January 8, 1953, an interdepartmental committee under the chairmanship of the National Security Resources Board with members from the Departments of Defense, Commerce, and Labor, reported that precision jeweled watch movements were essential to national security in wartime and that the special skills required for the manufacture of jeweled movements could only be maintained by actual production of jeweled movements. The level of production at that time indicated that the special skills would be maintained. Consequently, no action on the part of the Government was deemed necessary.

In July 1953, based on information received by President Eisenhower that production and employment in the jeweled watch industry might decline to a point that would endanger the mobilization base, the Office of Defense Mobilization was asked to establish and chair an Interdepartmental Committee on the Jeweled Watch Industry, with members from State, Treasury, Defense, Commerce, and Labor. This committee, in the light of its conclusions, recommended on June 30, 1954, that:

"The Government take actions which will create conditions favorable to the continued manufacture of jeweled watch movements by the American jeweled watch industry at a level which will maintain an adequate base of skilled manpower capable of expanding to meet full mobilization requirements."

On July 24, 1954, the President approved the recommendation of the Tariff Commission to raise tariffs on imports of Swiss watches, based on the finding of economic injury to the horological industry. The President noted also that the action would have an important collateral effect in contributing to the maintenance of a satisfactory mobilization base.

As a consequence of the petition of December 1955, and my appointment, the whole question of the essentiality of the jeweled watch manufacturing industry and its special skill was again thoroughly analyzed.

CURRENT INVESTIGATION

I have participated in numerous conferences with various groups and individuals, discussing and analyzing all the various factors in the case. I have also visited plants of both the domestic manufacturers and the importers.

During the later part of August 1956, I visited Switzerland and obtained firsthand information on operations of the Swiss watch industry.

I have studied the testimony given at the watch hearings held in Washington on January 7, 8, and 9, 1957.

In addition to my personal investigations and analyses, I had the assistance of technical studies of key skills present in the jeweled watch industry to determine if such skills were to be found in other precision production industries, and, if found, to ascertain the degree, if any, of their interchangeability. Mr. C. Leigh Stevens, a consulting engineer, was appointed to assist in this study particularly from an engineering viewpoint. The Department of Labor undertook to determine not only the existence of similar key skills outside the jeweled watch industry and possible interchangeability, but also the training required for proficiency in the various skills and the manpower requirements to meet planned production schedules in a mobilization period.

An answer to the domestic manufacturers' petition involves at least three interrelated questions:

(1) Is the production capability of the industry threatened by the importation of watch movements produced abroad?

(2) Are the skills found in the industry essential to the national security and, if so, are they available only in that industry?

(3) Is the industry itself essential to the national security?

In the succeeding pages I shall endeavor to present some of the facts that have been gathered.

Due mainly, I believe, to a marked differential in labor rates, the ratio domestically manufactured jeweled watch movements to imports of foreign watch movements is steadily declining and U.S. production is rapidly reaching the point where it may not be commercially feasible for domestic jeweled watch movement producers to continue to manufacture. It seems to be generally accepted that there is a saving due to wage differential of approximately $4 in using an imported watch movement as compared to manufacturing a similar watch movement in this country.

In 1956, in domestic manufacturers' offerings to the trade, approximately 59 percent were movements of domestic manufacture and approximately 41 percent were movements of foreign manufacture. In 1957, it is estimated that the percentages will change to 48 percent domestic production and 52 percent foreign.

The public generally appears to be willing to accept a foreign watch movement in an American case about as readily as it would accept a U.S. watch movement in a U.S. case.

The advance in production methods for pin-lever watches has made this watch generally acceptable to the public in competition with the lower grade jewel watches.

The foregoing, although significant, pertains to the economic factors and can only be considered by the Office of Defense Mobilization in relation to paragraph 7 of the Trade Agreements Extension Act. The Office of Defense Mobilization has a responsibility for assisting in preserving a given segment of an American industry only insofar as impairment or elimination of such industry would threaten the national security.

Studies and analyses made of its mobilization requirements by the Department of Defense indicates that although the productive capability of this industry is desirable, emergency military requirements could be met through other sources of supply.

World War II requirements for jeweled watches and chronometers exceeded 6 million jeweled movements. However, as a result of greater use of nonjeweled watches and more restricted issuance to military forces, the 3-year mobilization estimate, as certified to this agency on December 26, 1956, calls for less than 400,000 movements, approximately one-fifteenth of World War II requirements.

The estimated 3-year mobilization requirements for timing mechanisms for ammunition, fire-control equipment, etc., also as of December 26, 1956, totaled approximately 183 million units. Mobilization production schedules planned with industry provide for the production of 149 million of these units by producers other than jeweled watch manufacturers.

In order to ascertain the dependence of the military departments and missile contractors on the jeweled watch industry as a producer of components for missiles, additional data were gathered. The jeweled watch firms identified 24 items which they produced in support of missile programs. Nine Department of Defense officials, including representatives of the Office of the Secretary of Defense and each military department, visited the plants of 17 principal missile contractors and contacted the military department laboratories having technical responsibility for safety and arming devices. Altogether interviews were conducted with 106 officials of these organizations. All contractors reported that they have adequate sources of supply for these items outside of the jeweled watch industry. The military laboratories identified 18 principal producers other than jeweled watch firms with demonstrated competence and facilities, and indicated also that there are a number of smaller companies which have been used successfully for the development and design of arming systems.

Accepting the above-mentioned military requirement for jeweled movements there seems to be no reason to be concerned from a defense standpoint. This requirement can be expected to be met through reserve stock, inventory buildup or more formal stockpiling. For standard items the defense services can rely upon the 5 to 6 million jeweled watches in the channels of trade plus the estimated 80 million jeweled watches in relatively good working condition in the hands of the American people. This trade and in-use inventory should continue indefinitely. It is believed that it would be sufficient to meet the essential civilian needs in an emergency.

In his study of the problem, Mr. Stevens tentatively identified four items of defense production which appeared to require a capability unique in the jeweled watch industry. Mr. Stevens also felt that the contribution of the jeweled watch industry, particularly in miniaturization, together with the lead time required to establish a jeweled watch production line amounted to essentially and that the industry should be preserved. In rechecking the Department of Defense experience with the items above mentioned, it was found that in the case of three items other manufacturers either had produced the items or were currently doing so. In the case of the fourth, one manufacturer produced faulty examples of the item. Arrangements have now been made with an instrument manufacturer to produce a second pilot quantity.

The Department of Labor study referred to above indicates very strongly that the alleged unique skill factor in the industry can hardly be used to justify a decision that the skills of the industry are essential to the national security.

The Department of Labor report indicates that of the nine sample skills agreed upon by the domestic manufacturers for study:

(*a*) Five were found comparable to those completely outside the horological industry, three being transferable with a 90-day break-in period, and two (horological methods engineer and model maker) with a year break-in training.

(*b*) Three actually exist in the importing phase of the industry and can thereby be considered immediately available. These skills would not be adversely affected by increased importation.

(*c*) Only one skill-hairspring truer was found to exist only in firms manufacturing pin-lever or jeweled-lever movements. This skill is no doubt highly critical to the industry. However, the 3 domestic plants which produced over 2 million movements in 1956 employed only 13 hairspring truers.

Of the entire 750 individuals estimated to be required to meet the mobilization production schedules for jeweled movements (the 400,000 movements mentioned earlier), only 240 would be considered skilled manual workers; 40 would be foremen; and 20 would be engineers and scientists; the other 450 would be semiskilled or less. Even if essential requirements estimates were off 100 percent, the manpower involved could hardly be considered the controlling factor, particularly on closer analysis of the other factors.

CONCLUSION

It is desirable to have a jeweled watch industry in being in this country for the contribution it can make, along with other precision manufacturers, for production of the timing devices and other items needed by civilian and military users both in peacetime and in emergencies. However, due to significant reductions in recent years in the mobilization requirements for jeweled movements, the tremendous advances in and diffusion of precision production technique, and the availability of necessary skills and production capacity, there does not appear to be a threat to the national security because of imports of jeweled watch movements.

RECOMMENDATIONS

It is recommended that the domestic jeweled watch manufacturing industry be advised that you are unable to find that the national security is being threatened because of the import of jeweled watch movements.

REPORT ON THE ESSENTIALITY OF THE WATCH INDUSTRY TO THE DEFENSE OF THE UNITED STATES BY C. LEIGH STEVENS

We were requested by the Office of Defense Mobilization to report upon the essentiality of the watch industry to the defense of the United States.

This request stemed from the fact that the watch industry had petitioned under section 7 of the Trade Agreements Extension Act for a finding of essentiality, which section, in effect, says that upon a fiding by the Office of Defense Mobilization that an industry is essential to the national security (defense) of the United States and upon confirmation of that finding by the President, then the President may take whatever action he deems fit to protect that industry in order that it may properly discharge its responsibility to contribute to that national security (defense).

The section makes no mention of economics, foreign relations, international friendships, trade balances, or any of the other facets of foreign or domestic manufacture of physical things for the American market. It uses the phrase "national security."

Yet, in the context of the discussions so far, one cannot but arrive at the conclusion that defense of the United States has been given lipservice only, and the discussions run far afield into productive costs, costs of living, efficiencies of manufacture, standards of living, tariffs, or what have you, and that the single simple fact of the ability to make a physical unit or component needed in the overall defense syndrom has been completely obscured. Since the size of the physical units which the watch industry makes as a matter of course have such a bearing on the problem, it might help in the understanding of the problem to look for a moment at the makeup of American industry in relation to the physical size of its products. A simple curve brings this crystal clear. A 60,000-kilowatt generating unit is illustrative of very large size of piece. Three or four plants have the capability of making them such as General Electric, Westinghouse and Allis Chalmers.

Since it is easily understood that power is essential and the great size of the pieces involved in big generators is so visually apparent, the essentiality of the plants to make them is visually determined and is unquestioned.

As the size of the individual piece being manufactured decreases, the number of plants engaged increases rapidly; great cross flows of capabilities take place until you begin to reach miniature sizes, and at the very small sizes of pieces of high precision you again find a very few plants such as Hamilton, Elgin, and Bulova. But here you need magnifying glasses to see, and visual determination is not so easy—the essentiality is there, and why is it there?

Because in our defense many of the vital instruments or weapons systems of defense are airborne. Because of this fact therefore, if you can reduce the size of a vital part in its lineal dimensions by one-half, then you reduce its volume to one-eighth, i.e., $2\times2\times2=8$, $1\times1\times1=1$, and volume is the basic problem of airborne devices.

And this problem of reduction in size can only be properly attacked by organizations in being who understand and work with small sizes and whose equipment is in daily use in that field.

Of course, by the use of job descriptions you can come up with interchangeable skills. Toolmaker for toolmaker, machinist for machinist, engineer for engineer. But a mere collection of skills in and of itself can produce nothing. They must we welded into an organization in being; managed, controlled, and directed.

This is so apparent in every walk of life that, to find serious consideration being given to allowing proven organizations in being to die or be put in mothballs on the basic premise that because skills are interchangeable they (the organizations) can be reconstituted willy-nilly, is amazing.

You don't have a church because you can collect a pastor, some deacons, and ladies aid until you weld them into an organization in being. You don't have a school through the collection of scientists and teachers, no matter how brilliant, until they are made into a functioning organization that becomes an educational institution. You don't fly a B–52 bomber with a collection of pilots, navigators, etc., until, by long hard arduous training, you have teamed those skills into an organization in being.

As one enters upon the study of this problem and becomes familiar with the building of new buildings, organizations, etc., for the defense effort and one sees the Sunday New York Times ads for engineers of all kinds and realizes the tremendous forces being exerted to destroy organizations in being by uprooting their personnel to form new untried organizations, you become amazed that it can happen.

And when you get to the watch industry specifically you realize how essential to defense that industry is in its field of small manufacture and how much it can and has contributed.

Four specific instances are more than sufficient to prove the point:

1. The case of the T–336 mortar fuse mechanism which Bulova is now making on a directed procurement from Picatinny Arsenal.

There are a great number of mortar fuses of this type in stock. Unfortunately, they are imperfect to a great degree that their use in peacetime maneuvers due to personnel casualities is highly undesirable.

In August 1956 a directed procurement was given to Bulova for a new mechanism based on Frankfort Arsenal's design. There have been many changes (approximately 90) in the details of that design in order to produce the mechanism in quantity; 5,000 will be delivered in June and 170,000 in July, and peacetime maneuvers can be carried on without the danger to personnel that exists in those in stock.

Certainly, no new organization collected together would have even gotten really started, and secondly, no amount of rationale can gainsay the fact that when the problem arose a watch company was in being of proven capabilities who could and did pick up the load, for the problem was in their field.

No amount of speeches can change the fact that the approach to this problem was in every way correct, and that because of the existence of these problems in the field of small manufacture filled by the watch industry then the watch industry is essential for their solution.

2. A second case lies in the field of Elgin's entering into the electrical relay business.

Not only did Elgin improve the performance of standard relays but they completed a design which was dormant because of its small size and produced a miniature relay so small that it could only be best manufactured in their watch factory.

Its possibilities are great and except that they designed it in a partial vacuum as regards specific needs it is a real contribution to miniaturization. The potential uses of these devices are very great. The difficulty is that the services know they have a great need for this type of development in the relay field and that they did not seek out a source for it and promote its creation. Watch companies are naturally the place to turn for this effort.

3. A third case in point is the manufacture of reading and writing heads for use in computers.

These are small electrical devices generic to computers. They record and pick up the electrical impulses upon which the computer is dependent for its function. They are, as illustrated by the Hughes Aircraft sample, about ¾ by ½ by ¼ inch in dimension and contain several extremely small parts. They are a natural product for a watch plant. Watch plants contain all the equipment necessary to make them. The skills required are inherent in watch manufacture. Further, watch plants are already organizations in being, functioning properly in the coordination of production, engineering, tooling, machinery and equipment, and trained skilled workers.

To allow new facilities to be built and the consequent disruption and uprooting of personnel to man them, taken from already functioning organizations, is wasteful of the national assets. If such waste of the Nation's assets is essential to the defense of the country, then no present functioning industry is essential to its defense. A study of this small assembly wherein the watch industry can prevent waste is enough in itself to prove essentiality. If this not be true, then carried to its logical conclusion the country can only be defended by devouring itself, and in that event you have nothing left to defend.

4. The fourth and most impressive illustration of the essentiality of the watch industry is the chronology of the 10-to-the-3d gyro developed at the instrumentation laboratory of the aMssachusetts nIstitute of Technology.

The 10-to-the-3d gyro is a miniature gyro of broad application in the control of missiles, planes, etc. It was first presented in prototype form on March 24, 1954, to a meeting of possible producers as a classified item.

On January 15, 1955, it was publicly presented by an organization claiming productive capability and declassified. On January 25, 1955, the laboratory ordered one which was promised for delivery April 15, 1955. It was received November 7, 1955, tested by the laboratory, found unsatisfactory, and returned to the producer on February 20, 1956. No effort has been made to supply the laboratory with a satisfactory gyro since that time, of which the laboratory is aware.

On June 9, 1955, the Bulova Watch Co. was given a contract with no compensation to make production studies of tooling and manufacture, which contract was completed April 25, 1956. On January 15, 1957, bids were requested from possible suppliers, which bids were submitted and evaluation of them started. On April 15, 1957, the procurement requests were canceled.

The laboratory knows of no satisfactory 10-to-the-3d presently available.

If this gyro had been given to a watch company in 1954 when it was first presented for manufacture, it would be in full mass production today. All the evidence confirms the essentiality of the watch industry for this component, a component highly essential to control of planes and missiles, one which represented a major substantial advancement of the art. This component is still 1 to 2 years away from tooling and production. That this could happen is amazing and horrifying. It brings into sharp relief the folly of building new facilities, assembling new organizations to produce for American defense, and allowing the destruction of organizations of great skill and experience already in being. Certainly the study of the watch industry in relation to defense brings you inescapably to the conclusion that it is essential and should be preserved.

THE SECRETARY OF DEFENSE,
Washington, February 8, 1958.

Hon. GORDON GRAY,
Director, Office of Defense Mobilization.

DEAR MR. GRAY: On August 12, you addressed a letter to the Secretary of Defense on the subject of essentiality of the jeweled watch segment of the horological industry to the Department of Defense in times of national emergency. Secretary Wilson responded on September 19, and your letter of October 7 requested additional information relating to the horological industry as a whole. In your letter of October 7 you requested information on the following three specific points: (1) Revised projections of requirements based upon current planning estimates, (2) ability to obtain these requirements from other than the horological industry, and (3) in the event there would be a necessity for utilization of the capabilities of the horological industry to what extent would reliance be placed upon the jeweled as compared with the pin-lever watch and clock segment of the industry.

The Department of Defense has completed an exhaustive study of this subject, participated in by all elements of the Department having a significant interest in the answers to these questions. A copy of the report made to me is attached for your information and appropriate use.

The Department of Defense does not consider that it would be necssary to rely upon the horological industry for any substantial contribution in support of a possible future national emergency. It is our conclusion, therefore, that the horological industry is not essential in the supply of items critically needed by the Department of Defense in times of national emergency.

Subsequent to the receipt of your letter of October 7, you orally requested the Department of Defense to give special consideration to the research and development contributions which might be made by the horological industry. During the past few months, careful study has been given to this aspect of the study and visits have been made by staff of this office and the military departments to view the research projects and facilities of horological firms. No significant or promising research was observed that would support the idea that the industry, because of its special techniques, is essential to the security of the United States.

Notwithstanding these conclusions, the horological industry has a good record of military support, and on a competitive basis we will use them whenever we can.

Sincerely yours,

DONALD A. QUARLES, *Deputy.*

ASSISTANT SECRETARY OF DEFENSE

Washington, D.C.

REPORT OF THE DEPARTMENT OF DEFENSE ON THE ESSENTIALITY OF THE HOROLOGICAL INDUSTRY TO THE PRODUCTION AND DEVELOPMENT OF MILITARY EQUIPMENT, AS REQUESTED BY THE DIRECTOR OF DEFENSE MOBILIZATION

The Department of Defense has assembled extensive production requirements and planning data as a result of surveys conducted in response to requests from the Office of Defense Mobilization to determine the essentiality of all segments of the horological industry in the supply of items critically needed by the Department of Defense in times of national emergency. The scope of the Department of Defense activities, as well as the form of its report, have been based upon guidance and agreements reached early in 1956 with the ODM Advisory Committee on the Watch Industry and confirmed or modified by letters of the Director of Defense Mobilization on August 12 and October 7, 1957. Initially the decision to study the industry was made by the Office of Defense Mobilization as a direct result of the petition of the jeweled watch industry and subsequent petition of nine pin-lever watch and clock manufacturers, for relief under section 7(b) of the Trade Agreements Extension Act of 1955.

Originally it was agreed with the staff of the Office of Defense Mobilization that the Department of Defense would provide factual data only. This was completed by the submission to the Director of Defense Mobilization on December 26, 1956, of mobilization requirements and mobilization planning schedules of the military departments with industry. (See tab A.) The letter of August 12, 1957, to Secretary Wilson stated its purpose as confirming an understanding with staff of this Office to receive, with respect to the jeweled watch segment of the horological industry, "an expression from you as to the essentiality of this segment of the horological industry in the supply of items critically needed by the Department of Defense in times of national emergency". (See tab B.)

Secretary Wilson, in reply on September 19, 1957, concluded that:

"In summary, the facts which we have assembled, based on the latest available mobilization requirements estimates and the findings of a study of missile contractors, do not indicate major dependence upon the jeweled watch segment of the horological industry to meet Defense requirements. Despite the downward trend in our reliance upon the jeweled watch industry, the Department of Defense must say that it is a very desirable industry with a commendable record of assistance in meeting Defense needs, both in peacetime and under mobilization."

This letter, in providing background, stated that the Department of Defense in 1954 and 1955:

"* * * reported that the entire horological industry was considered essential to meet military mobilization requirements. Since that time, planning concepts and mobilization requirements have changed significantly, as will be discussed in this letter. While we cannot now report that this industry is essential to the same degree, we wish to emphasize the fact that the entire horological industry continues to be a desirable and important source of supply for military goods, both in peacetime and in times of national emergency." (See tab C.)

In a letter on October 7, 1957, the Director pointed out that the Office of Defense Mobilization also had "pending before it a petition of the pin-lever watch and clock industry for relief under section 7 of the Trade Agreements Extension Act."; that "some further review of mobilization requirements planned for production by the nonjeweled segment may be necessary to an adequately informed decision," and suggested that in our "reply to this request it might be desirable to deal with the total horological industry." This letter also asked for additional information as follows:

"* * * It is requested, therefore, that you furnish us the following information as soon as it is available.

"1. Revised projection of requirements based upon your current planning estimates.

"2. Ability to obtain these requirements from other than the horological industry.

"3. If you believe there would be a necessity for utilization of the capabilities of the horological industry, to what extent would you rely upon the jeweled as compared with the pin-lever watch and clock segment of the industry." (See tab D.)

The report (tab A) submitted by the Department of Defense to the Director of Defense Mobilization on December 26, 1956, contained mobilization requirements for jeweled watches, chronometers, and aircraft clocks, safety and arming devices and mechanical timers for missiles and ammunition; timing devices for photographic equipment and fire control, and a series of miscellaneous items including nonjeweled watches and clocks. These data have been carefully reviewed to determine whether they apply equally to all segments of the entire horological industry. Except for gyroscopes, which were not included in the report of December 26, 1956, the mobilization requirements contained in the report include the total needs which the entire horological industry is known to be able to produce.

A separate study of gyroscope requirements and capacity conducted under the ODM components supply-deficiency program concluded that there is adequate capacity to meet mobilization needs without dependence upon the United States Time Corp. There are at least 35 producers. United States Time Corp. is a major manufacturer of gyroscopes and the only important manufacturer from the horological industry. The gyroscope business of this firm is sufficiently large to be self-sufficient in itself.

We have reviewed carefully the order boards we secured from all horological firms covering prime contract, subcontract, research and development, and parts supply, from 1951 through June 1957. We have also studied carefully the field reports submitted by our representatives visiting the missile manufacturers. The missile survey covered 18 firms having 21 plants and building 26 missiles, as indicated by the watch industry as important to them. Both executive and technical levels were consulted in each firm. In securing these data the missile firms were told that their individual experience would not be released to the public. All firms indicated they were not dependent upon the jeweled watch industry. Except for the United States Time Corp. gyroscope, alternative sources indicated by the missile manufacturers were outside of the horological industry. (See tab E.)

Technical laboratories having responsibility for safety and arming devices for missiles, including Sandia Corp. through the Atomic Energy Commission, reported a large number of nonhorological firms as having experience in both the design and manufacture of safety and arming devices for missiles and ammunition. A survey of 37 nonhorological firms by representatives of this Office and the Diamond Ordnance Fuze Laboratory and the armed services procurement planning officers, revealed capacity to produce over $1,200 million in value of safety and arming devices without disturbing that capacity already planned for other military items or for the defense-supporting economy. Attached is a summary report of this survey presenting these facts. These firms also were told that individual plant data would not be released without their expressed permission. (See tab F.)

The letter of October 7, 1957, requested additional data be furnished as outlined below:

"1. Revised projection of requirements based upon your current planning estimates."

A detailed computation by the military departments will be available shortly and will be forwarded under separate cover. The attached estimates are satisfactory for these analyses, and represent the latest strategic concepts. Mobilization requirements decline very sharply from the levels reported in the study of December 26, 1956. The decline of 75 percent for all VT fuses is typical. The aircraft and naval mobilization requirements which use jeweled lever escapements also decline approximately 75 percent. (See tab G.)

"2. Ability to obtain these requirements from other than the horological industry."

The safety and arming devices represent the largest volume in terms of dollars or units of the items which the horological firms could produce for defense during mobilization or currently. The survey shows conclusively that nonhorological firms can meet the entire requirements. The missile industry survey also clearly shows that nonhorological firms can produce the items these horological firms supplied to the missile manufacturers. Only the watch cannot be produced in other firms, but the mobilization requirements for watches have declined very sharply, because of drastic changes in the policy of issue to troops, even below the levels reported in the December 26, 1956, report.

"3. If you believe there would be a necessity for utilization of the capabilities of the horological industry, to what extent would you rely upon the jeweled as compared with the pin-lever watch and clock segment of the industry?"

The Department of Defense studies reveal that the horological industry as a whole is not essential to the production of military equipment. This does not mean that this industry will not participate in military procurement. It merely means that there are competitors which can produce items this industry manufactures for defense and that they can meet the total demands for defense, except for jeweled watches, which were covered above. Therefore, this Office would not attempt to distinguish which segment ultimately would be used more under these circumstances.

After receipt of the letter of October 7, 1957, the Department of Defense was asked by the Director to comment on the essentiality of research and development of the horological industry to the production of military equipment. When the Director requested that research be considered, arrangements were made for staff of the Assistant Secretary of Defense (Research and Engineering) and the military departments to visit both segments of the horological industry, as well as certain nonhorological firms. The Assistant Secretary of Defense (Research and Engineering) reported they "observed no highly significant or promising research that would support the idea the industry as a whole is, because of its special techniques, essential to the security of the United States." (See tab H.)

Research and development was given consideration in the many other phases of this study. Specifically, the order boards requested from the horological firms included a list of every research project undertaken by these firms for military equipment from 1951 through June of 1957. In the case of the missile survey, the teams analyzed the experience of the firms with production engineers, procurement specialists, and particularly, the design engineers. Many of these officials had been with the missile projects during the period of research and development and many of the missiles studied were still in various stages of development. No missile manufacturer visited indicated dependency upon the horological industry for research. Development was a primary consideration of the service laboratories consulted in connection with the safety and arming devices used in missiles. They advised that the nonhorological firms reported by them as having experience to produce these items have a design capability as well.

Visits to a selection of manufacturers of guidance systems for important missile systems provided similar conclusions to those obtained from missile manufacturers; that loss of the horological industry would not affect their production of guidance systems for missiles. (See tab I.)

The Director of Guided Missiles states, "Viewed solely from the standpoint of the potential contribution to the guided missile programs, it is evident that the horological industry cannot be considered to be essential to these programs. To the extent the facilities of the horological industry are available to us, we shall continue to utilize them in competition with other qualified producers in nonhorological industries." (See tab J.)

In summary, the Department of Defense does not find that the horological industry is essential in the supply of items critically needed by the Department of Defense in times of national emergency. Despite this fact, the Department of Defense recognizes the horological industry has a good record of contribution and, on a competitive basis, Defense will continue to use the industry wherever it can.

Perkins McGuire,
Assistant Secretary of Defense
(Supply and Logistics).

TAB A

DEPARTMENT OF DEFENSE REPORT OF DECEMBER 26, 1956

ON THE JEWELLED WATCH INDUSTRY

NOTE: PAGES 13 THROUGH 40 COVERING TABLES I THROUGH X HAVE BEEN REMOVED IN ORDER TO DECLASSIFY THIS TAB.

ASSISTANT SECRETARY OF DEFENSE
WASHINGTON 25, D.C.

Supply and Logistics
PC

December 26, 1956

Dear Mr. Flemming:

The attached data on Department of Defense mobilization requirements for items manufactured by the Jeweled Watch industry, and the status of Production Allocation Program planning for such items with industry in general and with the Jeweled Watch industry, are submitted in compliance with the request of the ODM Advisory Committee on the Watch industry.

These data are based on detailed computations of requirements, adjusted to represent, as closely as is possible at this time, current strategic concepts including the latest proposals of the Department of the Air Force. In effect, we have attempted to forecast the mobilization demand for the products which the industry has demonstrated it can produce, and further, to show the proportion of the demand which is covered by planned mobilization production schedules established by the military departments with firms in the Jeweled Watch industry, the Horological industry, and other industries.

Mobilization production requirements of course are subject to change with changes in strategic and operational plans, or changes in current procurement and mobilization reserve programs. However, we believe that these estimates, while not necessarily precise for individual items, can be taken as indicative of the general level of the demand in a mobilization.

In the case of timing mechanisms for proximity fuzes procured by the Navy, that department reported their operational requirements rather than an estimate of the demand on industry. These are adjusted to reflect the demands likely to be placed on industry and the adjusted estimates are incorporated in the attached data.

Tables I through VI show estimated mobilization requirements for jeweled watches and clocks, timing mechanisms for ammunition, guided missiles, fire control, photographic equipment, and miscellaneous products.

Tables VII through X show the specific mobilization production schedules that have been planned with industry for certain of these items. Specifically, planned mobilization production schedule data are available for watches and clocks, timing mechanisms for ammunition, photographic equipment, and some miscellaneous products. Planning for the timing mechanisms in guided missiles, fire control equipment, and certain miscellaneous products is a responsibility of the prime contractor and therefore data are not available.

A summary table recapitulates the data by product, and provides comparisons with similar data from the 1954 study, where possible. It should be noted that the jeweled watch companies did not show current procurement of timing mechanisms for many of the guided missiles, particularly those of the Department of the Army. These missiles were reported because they contain timing mechnaisms. It is not known at present what firms have produced or will produce the timers.

The requirements estimates are net rather than gross, in that they reflect the quantities to be procured from industry after all inventories and other assets have been considered. If military mobilization reserve stocks increase over a period of years, obviously the post-mobilization demand upon industry will decline correspondingly. If equipment becomes obsolete, and more modern equipment is needed, the net requirements will increase. Thus, while the requirements have declined during the past two years, it is possible that demand for new products can result in an increase in the future. Certain missiles are likely to replace certain ammunition items (not necessarily on a one-for-one basis), but neither the industry source nor the quantity can be foretold at this time.

While the estimates represent net demand upon industry, it is not always possible to reflect this in the quarterly phasing, since current procurement and other factors can change while the computation of requirements is in process. Consequently, it is not recommended that conclusions be based on analysis of the quarterly data, particularly for the early stages of the mobilization period. Analysis should be based upon the three-year mobilization requirement, or no less than the first two years.

Since net requirements have generally decreased, planning with industry may exceed the mobilization requirements for some items. As requirements are revised, planned production schedules with industry are adjusted to reflect the new data. Provision is made in the program for periodic review and the departments generally wait until significant changes are indicated, rather than making frequent adjustments which are expensive both to the Department of Defense and to industry.

It will be noted that current plans with industry account for more than 100% of the estimated mobilization requirements in all important categories. There is no question as to whether the total requirements can be met.

The following represents a complete list of the reports and data that have now been developed and transmitted by the Department of Defense to the Office of Defense Mobilzation and Departments of Commerce and Labor.

a. Reports from the Jeweled Watch industry, which show:

(1) Prime contract procurement of the Department of Defense from 1951 to date;

(2) Subcontract procurement from the industry by other military producers from 1951 to date;

(3) Research and development work of the jeweled watch firms for the Department of Defense and for other producers of military equipment;

(4) Parts supplied to producers of military equipment; and

(5) Parts procured by the jeweled watch industry for the manufacture of military items.

b. The same types of reports from certain non-jeweled watch and clock companies and related manufacturers.

c. The consolidated reports enclosed herewith, based on data computed by the military departments which show:

(1) Mobilization requirements for items currently produced or expected to be produced by the jeweled watch firms in the event of mobilization;

(2) Planned Mobilization Production Schedules for such items, for all firms with which production planning has been conducted by the military departments.

The computations made by the military departments have required many thousands of manhours. It is not likely that similar data could be compiled for the military products and schedules of the remaining firms in the Horological and related industries in less than six months. Considerable information on this subject, however, may be inferred from the fact, shown by the reports submitted herewith, that other firms do manufacture many of the same items that are reported by the Jeweled Watch industry. In fact, for ammunition timing mechanisms alone, other industries account for about 65% of the planned production. We are hesitant to proceed to develop these additional mobilization requirements data, knowing that it would take considerable time, without further word from you that this is necessary. Unless we hear from you, the Department of Defense accordingly will consider this assignment completed.

Sincerely yours,

/s/ R. C. Lanphier, Jr.
R. C. LANPHIER, JR.
Deputy Assistant Secretary of Defense
(Supply and Logistics)

11 Enclosures (1)
1. Summary
2. Table I-Mob Req, Jeweled Movements
3. " II- " ", Timing Mech for Ammo
4. " III- " ", " " " Missiles
5. " IV- " ", " " " Fire Cont.
6. " V- " ", " " " Photo Eqpt
7. " VI- " ", " " " Misc.
8. " VII- Prod Plg for Jeweled Movements
9. " VIII- " ", Timing Mech for Ammo.
10. " IX- " ", " " " Photo Eqpt
11. " X- " ", " " " Misc.

Honorable Arthur S. Flemming
Director, Office of Defense Mobilization

DECEMBER 19, 1956

DEPARTMENT OF DEFENSE
SUMMARY OF MOBILIZATION PRODUCTION REQUIREMENTS AND PRODUCTION ALLOCATION PLANNING WITH INDUSTRY OF PRODUCTS MANUFACTURED BY THE JEWELED WATCH INDUSTRY

Item	Total Three Years 1956 Report	1954 Report
Jeweled Watches and Clocks		
Total Requirements	392,784	747,670
Total Planned with Industry	393,770 1/	-
Percent of Requirements Planned with Industry	100.2 1/	-
Percent of Planned Requirements Placed with JWI	80.2 1/	-
Percent of Planned Req. Placed with Horological Industry	99.2	-
Timing Mechanisms for Ammunition		
Total Requirements	182,729,830	309,824,870
Total Planned with Industry	226,420,750	163,147,000
Percent of Requirements Planned with Industry	123.9%	52.6%
Planned with JWI as a percent of Total Planned	34.1%	21.4%
Planned " Horological Ind.as a percent of Total Planned 3/	62.0%	
Planned " Non-Horological Ind.as a percent of Total Planned	28.8%	
Planned " Importers" Domestic Fac.as a Percent of Total "	9.2%	
Timing Mechanisms for Guided Missiles		
Total Requirements	399.555	2/
Timing Mechanisms for Fire Control Equipment		
Total Requirements	24,644	2/
Timing Mechanisms for Photographic Equipment		2/
Total Requirements	30,180	
Total Planned with Industry (4 Air Force Items Only)	30,856	
Percent of Requirements Planned with Industry	102.2%	
Percent of Planned Requirements Planned with JWI	0.0%	
Miscellaneous Timing Mechanisms		2/.
Total Requirements (Including Hourmeters)	295,658	
Total Requirements (Excluding Hourmeters)	169,173	
Total Planned with Industry	170,085	
Percent of Req.(Excl. Hourmeters)Planned with Industry	100.5%	
Percent of Req.(Incl. Hourmeters)Planned with Industry	57.5%	
Total Non-Jeweled Timers Planned with JWI	33,000	

FOOTNOTES:

1/ Entire picture not shown. Formerly the Department of the Army required 881,000 Grade III movements, 7 jewel and above, which were planned with industry. The requirements for Grade III movements, whether jeweled or non-jeweled, have been eliminated by the Department of the Army. It is assumed this planning could be used for other movements and capacity is more than adequate to meet requirements.

2/ No comparable data available.

3/ Covers jeweled and non-jeweled watch, clock, and industrial timing manufacturers.

Inclosure 1 to

TAB B

LETTER OF GORDON GRAY TO SECRETARY WILSON

DATED AUGUST 12, 1957

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF DEFENSE MOBILIZATION
Washington 25, D. C.

Office of the Director

August 12, 1957

Honorable Charles E. Wilson
Secretary of Defense
Washington 25, D. C.

Dear Mr. Wilson:

As you know, the jeweled-bearing segment of the horological industry filed for relief under Section 7 of the Trade Agreements Act some time ago. In the meantime, this office has been conducting a study to determine the facts as to whether or not imports are of such volume as to threaten to impair the national security.

Your Department has been cooperating in the conduct of this study and this letter is to confirm our understanding with members of your staff that we will have an expression from you as to the essentiality of this segment of the horological industry in the supply of items critically needed by the Department of Defense in times of national emergency. Most of the data on which to base a conclusion has been gathered and we expect to be in a position to write a report as soon as your staff completes and evaluates the data it is now gathering on an aspect of the investigation, the need of which only recently became apparent.

For a number of reasons the period since the above mentioned filing was made has become quite extended, and this is to ask that your expression be sent to us as soon as you can conveniently do so.

Sincerely yours,

/s/ Gordon Gray
Director

TAB C

LETTER OF SECRETARY WILSON TO GORDON GRAY DATED SEPTEMBER 19, 1957

THE SECRETARY OF DEFENSE
Washington

August 19, 1957

Dear Mr. Gray:

Your letter of August 12, 1957 refers to the fact that the jeweled-bearing segment of the domestic horological industry has filed for relief under Section 7 of the Trade Agreements Act, and that you are conducting a study to determine whether imports of jeweled timepieces are of such volume as to threaten to impair the national security.

As you know, this matter was the subject of study by the interested Federal agencies in 1954 and 1955, and the Department of Defense then reported that the entire horological industry was considered essential to meet military mobilization requirements. Since that time, planning concepts and mobilization requirements have changed significantly, as will be discussed in this letter. While we cannot now report that this industry is essential to the same degree, we wish to emphasize the fact that the entire horological industry continues to be a desirable and important source of supply for military goods, both in peacetime and in times of national emergency. Since 1951 the horological industry has produced Defense items costing more than $425 millions. The industry has a commendable record of performance. We are also pleased to note that watch importer-assemblers can contribute to Defense requirements, and that one of these companies has performed in its domestic plant over $80 million of prime and sub-contract Defense work since 1951.

Your letter of August 12 requests that we advise you specifically of our current estimate of the essentiality of the jeweled watch segment of the horological industry. The question under consideration is whether sufficient production of jeweled watches should be sustained to keep this part of the production force employed in peacetime so as to assure its availability in the event of mobilization. In order to answer this question from the Department of Defense viewpoint, we have examined the kinds of items now being procured from these particular companies by the military services, and the plans which have been made to utilize the capacity of these companies, as compared with other sources of supply, under mobilization. We have also explored the present utilization of jeweled watch firms by 17 missile contractors. The findings of these studies are summarized below.

The jeweled watch industry produces for Defense needs principally the following: (1) jeweled watches and chronometers; (2) timing mechanisms for ammunition, etc.; and (3) various devices in support of missile programs.

Jeweled Watches and Chronometers

With respect to these items, the jeweled watch industry is the only domestic source of production. However, as you know, our mobilization requirements for jeweled timepieces are no longer of significance from the point of view of the demand placed on industry capacity, either in peacetime or under mobilization. Whereas World War II requirements exceeded six million jeweled movements, our estimated mobilization requirements have steadily declined since World War II, due to greater use of non-jeweled watches and the more restricted issuance to the military forces. The three-year mobilization estimate reported to you on December 26, 1956 calls for less than 400,000 movements. This is but a fraction of the current annual production of the domestic industry.

Timing Mechanisms for Ammunition, Fire Control Equipment, Etc.

In the detailed study of items procured from the jeweled watch industry submitted to your office in April 1954, we reported that these devices are also procured from non-jeweled watch manufacturers and from producers outside of the horological industry. The data submitted to you in December 1956 show that our estimated three-year mobilization requirements then totalled approximately 183 million units. Mobilization production schedules planned with industry provide for the production of 150 million units by producers other than jeweled watch manufacturers. I should further report to you that our mobilization requirements for these items are now being re-evaluated under the latest planning concepts, and it now appears that the quantities will be significantly reduced. This means that, if necessary, we would probably be able to meet these mobilization requirements from sources outside of the jeweled watch industry.

Devices Produced in Support of Missile Programs

The four jeweled watch firms were requested on July 16, 1957 to submit the latest production information bearing on this study and to identify the items which are or have been produced to support development and production of missiles. Their reports identified 24 such items, some of which (principally safety and arming devices) are procured direct by the military departments and furnished to missile contractors for incorporation in the weapon; and a variety of which are procured direct by the missile contractor.

In order to ascertain the dependence of the military departments and missile contractors on the jeweled watch industry, 9 DOD officials including representatives of my office and of each military department, visited the plants of 17 principal missile contractors and contacted the military department laboratories having technical responsibility for safety and arming devices. Altogether interviews were conducted with 106 officials of these organizations.

All contractors reported that they have adequate sources of supply for these items outside of the jeweled watch industry. The military laboratories identified eighteen principal producers other than jeweled watch firms with demonstrated competence and facilities, and it was reported that there are a number of smaller companies which have been used successfully for the development and design of arming systems.

The teams which visited missile contractors reported that jeweled watch firms apparently have not actively sought to obtain a strong position in performing work for missile contractors.

In summary, the facts which we have assembled, based on the latest available mobilization requirements estimates and the findings of a study of missile contractors, do not indicate major dependence upon the jeweled watch segment of the horological industry to meet Defense requirements. Despite the downward trend in our reliance upon the jeweled watch industry, the Department of Defense must say that it is a very desirable industry with a commendable record of assistance in meeting Defense needs, both in peacetime and under mobilization.

We will be glad to review the above findings with you and to furnish any additional data regarding our requirements which will assist you in reaching a conclusion in this matter.

Sincerely yours,

/s/ C. E. Wilson

Honorable Gordon Gray
Director
Office of Defense Mobilization

TAB D

LETTER OF GORDON GRAY TO SECRETARY WILSON

DATED OCTOBER 7, 1957

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF DEFENSE MOBILIZATION
Washington 25, D. C.

Office of the Director October 7, 1957

Honorable Charles E. Wilson
Secretary of Defense
Washington 25, D. C.

Dear Mr. Wilson:

Reference is made to my letter to you of August 12th and your reply of September 19th. As you know, the Office of Defense Mobilization also has pending before it a petition of the pin-lever watch and clock industry for relief under Section 7 of the Trade Agreements Act. We had hoped to be able to reach a decision on the petition of the jewel segment of the industry prior to the completion of the non-jewel study, but it now appears that some further review of mobilization requirements planned for production by the non-jewel segment may be necessary to an adequately informed decision. We have for some time been in discussion with members of your staff with respect to this point.

It is our understanding that during your studies of the essentiality of the jeweled watch industry, you obtained data with respect to the pin-lever watch segment of the industry and that you are now supplementing and analyzing this information. Recalling that you have previously considered this question from the standpoint of the horological industry as a whole, it occurred to me that in your reply to this request it might be desirable to deal with the total horological industry.

It would be helpful to the Office of Defense Mobilization in its current consideration of the essentiality of the horological industry, if certain additional information could be provided. It is requested, therefore, that you furnish us the following information as soon as it is available.

1. Revised projection of requirements based upon your current planning estimates.

2. Ability to obtain these requirements from other than the horological industry.

3. If you believe there would be a necessity for utilization of the capabilities of the horological industry, to what extent would you rely upon the jeweled as compared with the pin-lever watch and clock segment of the industry.

We believe that this approach will serve to clarify the question of the essentiality to the national security of the horological industry, from a Department of Defense point of view, in both its jeweled and non-jeweled segments.

For your information a copy of a report written by Mr. George B. Beitzel on his study of the jeweled watch industry is attached. Since it is not planned to make this report public until a decision is reached in the jeweled watch case, this report will be classified "For Official Use Only" until that time.

Sincerely yours,

/s/ Gordon Gray
Director

Attachment

TAB E

REPORT, INCLUDING FIELD REPORTS OF OFFICE OF THE SECRETARY OF DEFENSE REPRESENTATIVES ON VISITS TO MANUFACTURERS OF GUIDED MISSILES AND SERVICE LABORATORIES.

SUMMARY OF THE SURVEY OF MISSILE MANUFACTURERS TO DETERMINE THE ESSENTIALITY OF THE JEWELED WATCH INDUSTRY TO THE MANUFACTURE OF MISSILES

The Jeweled Watch Industry contends that it is essential to the manufacture of missiles. The Director of Defense Mobilization has asked the Secretary of Defense, in a letter dated August 9, 1957, to determine whether or not this is the case. Four survey teams representing the Office of the Secretary of Defense visited all of the important missile manufacturers and established the actual record of procurement experience and deliveries with the Jeweled Watch Industry. Lists of the twenty plants visited, covering twenty-five missiles, and the membership and itinerary of the survey teams, are attached. All of the missile manufacturers reported by the jeweled watch companies as obtaining products from these four firms, were included in the survey and the specific orders discussed with management. A list of these products is also attached.

The survey teams were instructed to explain the nature of the visit to executive management first; then obtain information from the procurement, design and production of engineering staff; and finally, to return to executive management in order to outline for purposes of confirmation, what the survey team found to be the experience of the firm in using the Jeweled Watch Industry, horological firms and other sources. This was done in every case. In addition, visits were made to the Naval Ordnance Laboratory having technical responsibility for safety and arming devices for all naval, and some other missiles, and the Diamond Ordnance Laboratory in Washington having similar responsibility for the Army.

Every missile firm had good sources of supply completely outside of the horological industry for every item listed by the Jeweled Watch Industry.

There was no single instance in which a missile firm felt that development or production was dependent upon the capability of the Jeweled Watch Industry or any horological firms. Sources outside of the horological industry as a whole were manufacturing all of the products reviewed.

Missile manufacturers stated (1) that the Jeweled Watch Industry was not aggressive enough to obtain the business; (2) the items involved were dependent upon a different know-how and therefore represented diversification of production to the Jeweled Watch firms in the same way that it represented diversification of production for other firms; (3) precisions for the missile systems frequently exceeded the capability of the Jeweled Watch Industry; (4) the industry must participate at the time of development to secure important business; and (5) there are millions of dollars of procurement which the Jeweled Watch Industry could secure if it would use the engineering sales techniques of producers goods manufacturers. These statements are substantiated by the fact that the four jeweled watch manufacturers reported only $8.6 million of subcontract support from 1951 to June 30, 1957 for all manufacturers of all military equipment.

The safety and arming devices can be produced by at least eight other manufacturers, who have the same ordnance capability that the jeweled watch firms have developed. This ordnance know-how is in no way dependent upon jeweled watch manufacturing capability. The Jeweled Watch Industry does represent excellent capacity to manufacture safety and arming devices and have competitively secured a considerable amount of this business. They are very desirable in this field. They must and do compete with many other firms outside of the horological industry. There is a definite trend toward electronics as well as electro-mechanical devices to supplant mechanical timers and safety and arming devices in the missile.

Each of the team reports contain specific examples to support the statements outlined above. Not a single report of the four survey teams supports the contentions of the Jeweled Watch Industry that it is essential to missile development or production, or any suggestion that any part of the horological industry as a whole is.

Attachments

/s/ A. W. Buschman

TAB F

SUMMARY REPORT OF SURVEY OF NON-HOROLOGICAL FIRMS

SUMMARY REPORT: SURVEY OF NON-HOROLOGICAL FIRMS TO MANUFACTURE SAFETY AND ARMING DEVICES FOR AMMUNITION AND MISSILES

A survey of missile manufacturers and technical laboratories of the military departments during the month of August, 1957 revealed a large number of firms completely outside of the horological industry with capability and experience to design and manufacture safety and arming devices for missiles and ammunition. This information was transmitted to the Office of Defense Mobilization in connection with the study of the essentiality of the horological industry to defense. The question was then raised as to whether these firms will be expected to manufacture other military equipment in the event of a mobilization, thereby eliminating their potential to produce safety and arming devices.

The Department of Defense agreed to determine whether or not this was the case. Thirty firms were selected which had been certified by Service Laboratories as having this design and manufacturing capability and experience or were included because they were represented by the missile manufacturers as having experience and capability. Seven additional firms were included as domestic non-horological firms in which planning for safety and arming devices had already taken place, through the Production Allocation Program, but which might have capacity above and beyond that already planned.

Five teams were organized, each of which was composed of a representative from the Office of the Secretary of Defense and a technician on loan from the Diamond Ordnance Fuze Laboratory. In addition, the respective Armed Services Procurement Planning Officer joined the teams at the firms surveyed. Each team carried with it examples of safety and arming devices which were classed as a simple ammunition type item, a NIKE type safety and arming device presently under contract at approximately $20.00 and either a T2061 or a FALCON safety and arming device which varied respectively from approximately $100.00 to $200.00 in cost.

Initial explanation of the purpose and objectives of the study were given to executive management. The teams then discussed with planning and production officials the production schedules already planned with that firm and indicated that in no sense were these to be considered changed. Where extensive research and development existed in a firm which would likely result in mobilization demands, this too was to be considered as planned by management. The teams then discussed with management the defense-supporting demands under conditions of mobilization, in order that management might consider this capacity as already planned. Each firm was then asked to indicate the total number per day of each of the safety and arming devices it could manufacture on a one-shift operation. In some instances, management provided a figure which indicated the pattern of product mix they would prefer to use if they were required to produce more than one type. It was not necessary to use more than one pattern in the analysis. In all instances, executive management and technical production personnel were involved in the estimates.

Inclosure 5

These data were summarized by individual plant and converted to a total for one year on the basis of a forty hour week. The data were then increased by 2.5 times to represent a multi-shift operation, twenty percent to provide a forty-eight hour week, and three times to cover a three year period of mobilization. The data were reduced fifteen percent or by about five and one-half months of production to represent lead times and miscellaneous production delays. The aggregate figures for each type of item were developed into two main groups. First a total was made for all plants reporting NIKE capacity, whether or not they reported other types. The totals were added for those firms which reported a very complex device but not the NIKE and those firms which reported the simplest ammunition item but not the NIKE or very complex. These figures represent the pattern of product mix that was employed in the analysis. They revealed that 131.9 million units could be produced during the three year period, almost 106 million of which represent the NIKE type. On a dollar value basis, this represents $1,229 million dollars of capacity. A second pattern of product mix was developed in which a total was computed for all firms reporting first the very complex item. While this complex item had represented only 1,600,000 units in Product Mix No. 1, it represented 31,769,000 units in the second Product Mix. Those firms which did not report this very complex safety and arming device, but reported only a NIKE were added to the product mix for an additional 36,605,000 units. The same ammunition figure was used in this pattern. While the aggregate of all three items of this second product mix represented only 92,915,000 units, far more capacity was actually allocated to it by the manufacturers because of the greater integration of production required and in terms of dollar values it totalled $2,797 million dollars. The very complex portion of the pattern represented $2,382 million dollars.

Attachment B shows the individual plant data reported, together with the aggregate figures for each type. (This Table contains proprietary information and therefore company names were withheld.)

Attachment A shows the supply-demand analysis, including the aggregate figures for capacity and the aggregate requirements for each of the three series developed by the Department of Defense from 1954 to date on the basis of different strategic considerations.

For the purpose of comparison, the requirements in terms of numbers of units contained in the December 26, 1956 report were converted to dollars, utilizing the prices reported on the order boards by the horological firms for each unit. No reduction of these unit prices was made on the assumption of mass production. In the case of items used in the survey, the ammunition type was held at $2.00, a reduction was given to the unit price of the NIKE from $20.00 to $10.00 and of the other items were established arbitrarily at $75.00 though present prices range from $100.00 to $200.00. The average price resulting from the December 26, 1957 report was used for the estimates representing the latest strategic concepts and for the April 26, 1954 requirements data.

Table I reveals that requirements for the latest concept were as low as 74.9 million units or $306 million dollars. The December 26, 1956 requirements of 191 million units converted to $740 million dollars and the 1954 requirements of 310 million units converted to $1,179,451 dollars. Each of these figures were than reduced by as much as could be made by the non-horological and non-petitioning horological firms with whom planning had already taken place under the Production Allocation Program. This procedure draws the amount of requirements that would have to be met without using any of the petitioning horological firms. On the basis of the present strategic concept, there would be an excess of capacity of 18.6 million units or $40 million dollars. On the basis of the requirements reported in the December 26, 1956 report, there would still be a requirement of 87 million units, or $352 million dollars to be obtained from the surveyed facilities, and on the basis of the requirements contained in the April 26, 1954 report, there would be a requirement of 205 million units or $791 million dollars.

Obviously, no further analysis is necessary for the present strategic concept, as these could be met by those non-horological or non-petitioning firms with whom planning had already been conducted.

If the capacity of the surveyed facilities is used to meet the remaining requirements of the December 26, 1956 report, there is an excess of capacity of over $800 million dollars. Similarly, on the basis of the April 26, 1954 report, there is an excess of capacity of about $400 million dollars.

The manufacture of safety and arming devices in times of mobilization can easily be met by non-horological firms. These same firms actually have the capability to produce a more complex pattern of product mix and meet a greater dollar value of demand or $2,798 million dollars. There are a number of other firms which do not have actual experience in manufacturing these items, but do have similar capacity, and could be developed for this purpose.

In some instances data for the surveyed firms were not used because (a) management did not desire to participate and (b) could not devote any further capacity for this purpose, or (c) had capacity which the survey team agreed was more useful for complex military instruments which probably would be forthcoming from the drawing boards at a later date.

Attachments

Attachment A

SUPPLY AND DEMAND FOR SAFETY AND ARMING DEVICES USED IN MISSILES AND AMMUNITION

A:- CAPACITY OF NON-HOROLOGICAL FIRMS SURVEYED ABOVE ALL PLANNED ALLOCATION AND CIVILIAN DEMANDS OCTOBER 1957 1/

	Type	Unit Cost: Actual Contract	Unit Cost: Factor Used 2/	Capacity: Product Mix #1: Unit 000	Capacity: Product Mix #1: Dollars 000	Capacity: Product Mix #2: Unit 000	Capacity: Product Mix #2: Dollars 000
1)	Ammunition	$ 2	$ 2	24,541	$ 49,082	24,541	$ 49,082
2)	NIKE	20	10	105,704	1,057,040	36,605	366,050
3)	T-2061 or FALCON	100 to 200	75	1,640	123,000	31,769	2,382,675
4)	Totals			131,885	$1,229,122	92,915	$ 2,797,807

B: PRODUCTION REQUIREMENTS 3/

		Present Strategic Concept (Estimate): Unit 000	Present Strategic Concept (Estimate): Dollars 000	December 26, 1956 Report: Unit 000	December 26, 1956 Report: Dollars 000	April 26, 1954 Report: Unit 000	April 26, 1954 Report: Dollars 000
5)	Ammunition	74,495	$ 276,376	191,536	$ 710,166	309,825	$ 1,149,45[illegible]
6)	Missiles	400	30,000	400	30,000	400	30,0[illegible]
7)	Totals	74,895	$ 306,376	191,936	$ 740,166	310,225	$ 1,179,451

C: PLANNED PRODUCTION UNDER PRODUCTION ALLOCATION PROGRAM 3/

		December 26, 1956 Report: Unit 000	December 26, 1956 Report: Dollars 000
8)	Total planned with Industry	226,421	$ 840,022
9)	Total planned with Domestic Jeweled Watch Industry	77,234	286,538
10)	Total planned with Other Petitioning Horological Firms	55,708	206,677
11)	Total planned with Non-horological Non-petitioning Firms	93,479	346,807

ATTACHMENT A

(CONTINUED) SUPPLY AND DEMAND FOR SAFETY AND ARMING DEVICES USED IN MISSILES AND AMMUNITION

D: SUPPLY DEMAND ANALYSIS 4/

	Present Strategic Concept (Estimate)		December 26, 1956 Report		April 26, 1954 Report	
	Unit 000	Dollars 000	Unit 000	Dollars 000	Unit 000	Dollars 000
12) Unplanned Requirement (assuming Production Allocation) (Program planning with petitioning horological firms is not used - Line 7 minus Line 11)	(18,584) (Excess Capacity)	($40,431)	98,457	$ 393,359	216,746	$ 832,644
13) Excess Capacity (After satisfying all requirements by capacity recorded by October survey. Line 4 Product Mix #1 minus Line 12)			(See Note)	835,763	(See Note)	396,478

NOTE: (a) If this capacity were converted to equivalent units in terms of the average price reported on the order boards, there would be excess capacity of 225 million units based on the December 26, 1956 report and 107 million units excess based on the April 26, 1954 report.

(b) If non-petitioning horological firms are excluded from the planning data and the survey, even though these firms did not petition ODM and would be used although non-horological firms alone could meet all demands of the largest requirement (April 26, 1954) and continue to have well in excess of a hundred million dollars of capacity.

(Footnotes on Page 3)

(CONTINUED) SUPPLY AND DEMAND FOR SAFETY AND ARMING DEVICES USED IN MISSILES AND AMMUNITION

FOOTNOTES:

1/ The capacity data are based on survey of thirty-seven non-horological manufacturers conducted in October 1957 by the Office of the Secretary of Defense.

2/ This factor is lower than the present actual unit price to allow for larger quantity production. This factor is required to convert units to dollar value and thereby compare the capacity to requirements.

3/ Requirements were converted from units to dollars utilizing prices reported on the order boards of horological firms for the types of devices reported in the December 26, 1956 report. The average dollar value of $3.71 was applied against the totals of the estimates for the Present Strategic Concept and the April 26, 1954 report. This same average was applied to the total units planned under the Production Allocation Program.

4/ While units contained in the Production Requirement and Planned Production Tables can be compared directly, comparison of requirements to the capacity reported in the survey of thirty-seven firms can only be made in terms of dollar values.

ATTACHMENT B

CAPACITY OF SELECTED FIRMS TO PRODUCE SAFETY AND ARMING DEVICES FOR AMMUNITION AND MISSILES

NOTE: The individual plant data contained in this table is proprietary information to the firms and may not be released outside of the U. S. Government agencies participating in the study of the essentiality of the horological industry

Company Visited	TYPE of Safety and Arming Device	Units/Day 1 Shift 40 hr wk	Units/year 1 Shift 40 hr wk 000's	Units/year Multi-Shift 000's
1.	NIKE	8,000	2,000	
	Very Complex	4,000	1,000	
2.	Very Complex	100	25	
	NIKE	650	1,625	
3.	Very Complex	310	775	
4.		--	Capacity to be used for more complex precision instruments	
5.		--	Capacity to be used for more complex precision instruments	
6.	NIKE	800	200	
Company names withheld. See note above		150	375	
7.	NIKE	8,000	2,000	
	Very Complex	3,000	750	
8.	NIKE	2,500	625	
	Very Complex	500	125	
9.	NIKE	1,000	250	
	Very Complex	125	31	
10.	NIKE	60	15	
11.	NIKE	300	75	
	Very Complex	100	25	
12.	NIKE	1,000	250	
	Very Complex	200	50	
13.	NIKE	1,000	250	
	Very Complex	200	50	
14.	NIKE	300	75	
	Very Complex	100	25	

ATTACHMENT B

(CONT) CAPACITY OF SELECTED FIRMS TO PRODUCE SAFETY AND ARMING DEVICES FOR AMMUNITION AND MISSILES

NOTE: The individual plant data contained in this table is proprietary information to the firms and may not be released outside of the U. S. Government agencies participating in the study of the essentiality of the horological industry.

Company Visited	Type of Safety and Arming Device	Units/Day 1 Shift 40 hr wk	Units/Year 1 Shift 40 hr wk 000's	Units/Year Multi-Shift 000's
15.	NIKE	480	120	
16.	NIKE	7,200	1,800	
17.	NIKE	2,400	600	
18.	Ammunition	(32,000) (14,400)	(8,000) (3,600)	Capacity at Milwaukee is all planned. Figures representing Flint facilities are not included in analyses.
19. Company names withheld. See note above.		---	---	
		No additional capacity available		
20.		---	---	
		No additional capacity available		
21.		---	---	
		No additional capacity available		
22.	NIKE	6,000	1,500	
23.	Very Complex	36.4	9.6	
24.	Very Complex			
25.	Very Complex	36.4	9.6	
26.	Data not used pending completion of engineering study.			

(CONT) CAPACITY OF SELECTED FIRMS TO PRODUCE SAFETY AND ARMING DEVICES FOR AMMUNITION AND MISSILES

NOTE: The individual plant data contained in this table is proprietary information to the firms and may not be released outside of the U. S. Government agencies participating in the study of the essentiality of the horological industry.

Company Visited	Type of Safety and Arming Device	Units/Day 1 Shift 40 hr wk	Units/Year 1 Shift 40 hr wk 000's	Units/Year Multi-Shift 000's
27.	NIKE	5,000	1,320	
	Very Complex	5,000	1,320	
28.	Very Complex	36.4	9.0	
29.	Very Complex	409	108	
30.	Addtl. supplement	5,632	1,408	3,240
31. Company names withheld. See note above	Pyrotechnic	--	--	--
32.		No additional capacity available		
33.		--	--	--
34.	Ammunition	7,000	1,800	
35.	Ammunition	6,000	1,500	3,450
	NIKE	4,800	1,200	2,700
36.	NIKE	3,000	750	
37.	NIKE	2,500	625	
	Very Complex	2,000	500	

SUMMARY OF CAPACITY OF SELECTED FIRMS TO PRODUCE SAFETY AND ARMING DEVICES FOR AMMUNITION AND MISSILES

	Unit Price for Conversion	Unit/Day 1 Shift 000's	Units/3 years Multi-Shifts 48 hour week 3X2.5X20% Less 15% Lead Time 000's	Dollar Value 000's
Total Ammunition Type - Product Mix A	2	3,208	24,541	49,082
Product Mix B	2	4,700	36,016	72,032
Total Nike Type - Product Mix A	10	13,055	105,704	1,057,040
Product Mix B 1/	10		36,605	366,050
Total Very Complex Type-Product Mix A	75	239	1,640	123,000
Product Mix B	75	4,353	31,769	2,383,675

FOOTNOTE: 1/ Product Mix B of Ammunition is not used in the statistical analysis of Product Mix 2 in the Supply Demand Analysis Table as it would require a third Product Mix and wouldn't add to the analyses.

TAB G

ESTIMATED TREND OF MOBILIZATION REQUIREMENTS BASED ON LATEST CONCEPTS

Estimated Effect of Latest Concepts Upon Mobilization Requirements for Timing Devices of the December 26, 1956 Report

Type of Item Reported	Mobilization Requirements Reported December 26, 1956 1/	Estimated Percent Reduction 1/
Mechanical Time Fuzes		
Army	64,929,000	54
Navy	8,806,000	84
VT Fuzes	96,792,000	75
Rocket Fuzes	5,232,000	38
Missiles	2/	2/
Watches and Clocks	3/	3/

FOOTNOTES:

1/ Total number reported does not necessarily include requirements for all items. Requirements for types or items not reported are assumed to remain as previously reported.

2/ The total mobilization requirement reported in the December 26, 1956 report was used on the assumption that new production items could offset any estimated downward trends.

3/ The trend is clearly downward but the actual percentage decline is not available. A small group of watches is estimated to decline as much as 80 percent. Naval aircraft and Air Force airframes declined 75 and 73 percent by weight respectively, between the two aircraft schedules used for the report, which is an indication of demand for aircraft clocks. Naval ship schedules declined 76 percent.

Enclosure 2

TAB H

MEMORANDUM OF ASSISTANT SECRETARY OF DEFENSE FOOTE TO ASSISTANT SECRETARY OF DEFENSE McGUIRE, DATED FEBRUARY 1, 1958

ASSISTANT SECRETARY OF DEFENSE
Washington 25, D. C.

February 1, 1958

Research and Engineering

MEMORANDUM FOR THE ASSISTANT SECRETARY OF DEFENSE (S&L)

SUBJECT: Watch Industry

Members of our staff and R&D representatives of the military services visited the following watch manufacturing concerns: Bulova, Elgin, General Time, Hamilton and U.S. Time. Visits were also made to firms or institutions concerned with the design or manufacture of precision guiding systems or components for missiles as follows: Minneapolis Honeywell, Massachusetts Institute of Technology, and AC Spark Plug.

Our review of this situation has been confined strictly to the mechanical and engineering aspects of the problem. The conclusions and recommendations which follow are, therefore, confined to this aspect of the situation.

Our survey did not reveal outstanding research projects underway, in the watch industry. A detailed review of past and present government contracts in the various watch plants showed that most of the development work was the adaptation of watch mechanisms to supply a time function for such items as fuzes, etc. In other words, most of this work is aimed at product engineering.

<u>Conclusions:</u>

1. From our survey of this situation we conclude that the watch industry is an important industry for the American consumer.

2. We do not consider the watch industry essential to the security of the United States. Other industries can make precision mechanical parts to equivalent accuracy.

3. We observed no highly significant or promising research that would support the idea the industry is, because of its special techniques, essential to the security of the United States. In fact, most of the production machinery was either purchased from Swiss sources or adaptations or copies of Swiss machinery.

/ s/ Paul D. Foote
Paul D. Foote

TAB J

MEMORANDUM OF DIRECTOR OF GUIDED MISSILES TO ASSISTANT SECRETARY OF DEFENSE (SUPPLY AND LOGISTICS)

OFFICE OF THE SECRETARY OF DEFENSE
Washington 25, D C

January 31, 1958

MEMORANDUM FOR THE ASSISTANT SECRETARY OF DEFENSE (S&L)

SUBJECT: Essentiality of Jeweled Watch Manufacture to the Guided Missiles Program

Reference is made to my letter of 18 June 1957 to you on the same subject. Since that time, I have had opportunity to review more extensively the rapidly growing guided missile industry and feel that further clarifying comments on this matter are necessary.

The guided missile industry has a substantial capability, particularly its guidance and control contractors, in miniaturization including the capability for repetitive high quality and process precision. Any unique or peculiar capability the watch industry may have had in the past is rapidly being duplicated by other industries which have demonstrated a capability of equaling and even exceeding the precision and miniaturization work of the watch industry.

Viewed solely from the standpoint of the potential contribution to the guided missile programs, it is evident that the horological industry cannot be considered to be essential to these programs. To the extent the facilities of the horological industry are available to us, we shall continue to utilize them in competition with other qualified producers in non-horological industries.

The observations I have made above, of course, are intended to be limited to the contribution the horological industry is capable of making to the guided missile effort and should not be interpreted as going beyond this specific area. The question of essentiality or substantial reliance upon the industry for other Department of Defense programs, such as general research and engineering and production of safety and arming devices, is more properly within the area of responsibility of other elements of the Department of Defense and their observations and recommendations, of course, should be considered.

W. M. Holaday
Director of Guided Missiles

CC: ASD (R&E)

U.S. DEPARTMENT OF LABOR
Office of the Assistant Secretary
Washington
August 2, 1957

The Honorable Gordon Gray
Director
Office of Defense Mobilization
Executive Office Building
Washington 25, D. C.

Dear Mr. Gray:

For some months the Department has been engaged in a study with respect to the essentiality of jeweled-lever watch industry skills as a part of the mobilization base. This study is a part of the interagency examination of the jeweled-lever watch industry's application for relief pursuant to Section 7 of the Trade Agreements Act, as amended.

I am transmitting herewith the Department of Labor Staff Study. The report is an analysis of selected skills in the jeweled-lever watch industry from the point of view of their replaceability under mobilization conditions and of the manpower required by the industry based upon the mobilization requirements provided by the Office of Defense Mobilization. The study is a factual report of carefully delimited scope and does not purport to suggest the judgmental conclusions upon which your ultimate decision must be based.

The following findings appear particularly relevant to the question at issue:

1. Certain skills needed in jeweled-lever watch manufacturing cannot be developed from outside the horological industry without substantial additional training time.

2. There is a strong presumption, however, that most, if not all, jeweled-lever watch industry skills can be developed within three months from the similar skills found in pin-lever watch manufacture.

3. The mobilization (including essential civilian) production schedules for the jeweled-lever watch industry as reported by the Office of Defense Mobilization and translated into manpower requirements by the Department of Labor reveal a peak mobilization requirement for 8,000 workers as compared with 1956 employment of 7,500 workers. Only 750 of the 8,000 workers would be employed in the manufacture of jeweled-lever watch movements.

4. The jeweled-lever watch industry's peak mobilization requirement for key technicians and skilled horological workers would be about 1,540 as compared with September 1956 employment of 2,139. Generally, the estimated mobilization needs for workers in key occupations in this industry could be met without expanding employment beyond the 1956 level. However, such comparisons conceal large differences between occupations. The requirements for machine shop type workers, for instance, would be equal to current employment in these skills; the peak mobilization requirements for watch assemblers, adjusters and inspectors, on the other hand, would be only a fraction of the number now employed. The skilled occupations which are most "unique" to the jeweled-lever watch industry are those for which, based on estimated mobilization needs, there would be least mobilization requirements. (Of course, in a mobilization period workers in such occupations as watch assemblers, adjusters and inspectors not needed for watch production would be useful in other precision sub-miniature production.)

These findings are based upon the production requirements provided by ODM. They reflect the fact that the production expected from the jeweled-watch industry in current mobilization plans is relatively small.

In view of the high degree of transferability found between skills from the pin-lever watch industry and those of the jeweled-lever watch industry, great caution must be exercised in evaluating the mobilization requirements for these skills on the basis of production schedules for the jeweled-lever watch industry alone.

It should also be noted that the employment data reported for the jeweled-lever watch industry in the attached study do not include the personnel maintained by two of these firms in research and development facilities separate from their production facilities.

Sincerely yours,

/s/ ROCCO C. SICILIANO

Rocco C. Siciliano
Assistant Secretary of Labor

Enclosures

A

MANPOWER AND SKILL STUDY

of the

JEWELED-LEVER WATCH INDUSTRY

1956

A STAFF STUDY

U. S. DEPARTMENT OF LABOR

August 1957

This staff study was coordinated by the U. S. Department of Labor Technical Committee on Critical Occupations. The data dealing with Employment and Mobilization Manpower Requirements were prepared in the Bureau of Labor Statistics and the data on Skill Transferability in the Bureau of Employment Security.

A Manpower and Skill Study of the Jeweled-Lever Watch Industry

Table of Contents

Summary Listing of Tables

A
Manpower and Skill Study
of the
Jeweled-Lever Watch Industry

Introduction

This report made at the request of the Office of Defense Mobilization provides information on:

1. The number of workers in key watchmaking skills now employed in the jeweled-lever watch industry and employed in previous periods.

2. A projection of the manpower requirements for the jeweled-lever watch industry in a mobilization period, particularly for workers with key skills.

3. The transferability of skills from other industries to the key skills in the jeweled-lever watch industry with a minimum of additional training.

Summary of Findings

1. Employment in the jeweled-lever watch industry has been declining since the high level of 1948. This trend was reversed for the period of the Korean conflict but again turned down after 1954. The 7,524 employees in the industry in September 1956 was about 47 percent below the 12,265 workers in the industry in September 1948. The decline in employment in the last few years can be related to both the decrease in defense production in the industry, and to increased watch output per employee.

Despite declining employment in the industry, the production of jeweled-lever watch movements in 1956 was higher than in 1955 or 1954. The 2,112,000 watch movements produced in 1956 was 23 percent above the 1,716,000 output in 1954, and much above the 420,000 watch movements reported as needed in the peak year of a mobilization period by the ODM.

2. It is estimated that to produce the volume of goods allocated to the jeweled-lever watch industry by the Department of Defense in mobilization and to meet essential civilian needs would require 8,000 workers at the peak production year of the mobilization period. This production volume is primarily made up of ordnance items and consequently, only 750 of these workers would be employed in the manufacture of jeweled-lever watch movements. In the peak year of the mobilization period about 1,540 key technical and skilled horological workers would be required in the industry. This compares with 2,139 such workers that were employed in the industry in September, 1956. Generally the estimated mobilization needs for workers in key occupations could be

satisfied by workers in the industry in 1956. Foremen is the one important occupation in which the mobilization need is moderately greater than the number in the industry in 1956.

3. Many of the key workers now employed in the industry could be used directly in the production of the items which the industry will be called upon to make in a mobilization period. For example, the workers employed in machine shop work in watchmaking would be directly transferable to ordnance work. On the other hand, in the mobilization period the industry would require only a fraction of the number of watch assemblers, adjusters and inspectors that are currently employed. However, many of these skilled horological workers could be utilized in ordnance production, but would not be using their specialized horological skills. This study is primarily concerned with the need for key technical and skilled workers. But, firms in the industry must also be considered as highly specialized operating units carrying on a unique technology. It is recognized that such manufacturing units are difficult to replace.

4. Based on an analysis of nine jobs (See Table 6) considered representative of unique skills in the jeweled-lever industry, it is concluded that counterparts exist in the pin-lever segment of the clock and watch industry.

(a) Counterparts in the economy:
This appears true, at least, for eight of the nine jobs. The ninth job, Diamond-Tool Maker, is not found in the pin-lever industry which utilizes carbide rather than diamond tools. With respect to plants outside the clock and watch industry, four of the nine sample jobs were identified as counterparts to those occurring in the

jeweled-lever industry. These are the types of jobs which generally cut across industrial lines, and include Automatic Screw-Machine Set-Up Man; Diamond-Tool Maker; Methods Engineer; and Tool-and-Die Maker. The remaining five jobs were not identified in the plants surveyed outside of the clock and watch industry. This was to be expected since many industries develop techniques and methods that are specific to a product unique to that industry. The jobs found only in the clock and watch industry include Final Inspector; Hairspring Truer; Model Maker; Watch Adjuster; and Watchmaker. The appearance of the job of Model Maker in the latter list should be qualified somewhat. That part of the job of Model Maker involved in machining miniature parts to close tolerances is found outside of the clock and watch industry. The job duties and work techniques, however, involved in assembling the parts into a finished movement and bringing the movement to a specific standard of time were found only in the clock and watch industry. Outside of the clock and watch industry, Model Makers assemble components unique to their industry, such as precision aircraft instruments.

(b) Technology and Tolerances:

For the most part, jobs identified as counterparts to one of the nine, sample jeweled-lever jobs, utilize the same methods and techniques; require the use of comparable tools and machines; draw on comparable skills and knowledges; and require adherence to comparable tolerances. The range of workpiece dimensions dealt with in the jeweled-lever industry start at sizes smaller than are generally found in other industries, although considerable overlapping in sizes of parts does exist. Tolerances adhered to in the jeweled-lever industry, however, were not found to be unusual in either the pin-lever industry or in plants outside the clock and watch industry. The adherence to extremely close tolerances on a continuous basis in making and assembling miniature parts is, however, unique to companies producing watch movements.

In bringing the finished movement to time, jeweled-lever companies attain somewhat greater accuracy in watches than pin-lever companies. Jeweled-lever watches are usually timed to within + - 15-30 seconds over a 24-hour period, while pin-lever watches are usually timed to within + - 1-2 minutes over a 24-hour period. In addition, marine chronometers accurate to within + - 3 seconds a week and similar precision timing devices are not produced outside of the jeweled-lever industry.

(c) Training Within the Industry:

An analysis of the personnel records of work performed in the nine selected occupations revealed that the data were inadequate to have a bearing on the questions of job transferability and amounts of training necessary for successful performance in the selected skills. As such, the personnel records may be considered inadequate for purposes of this study. (See Appendix H).

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The training times of these nine representative jobs range from a minimum of 1½ years to 3 years for the hair spring truer and up to 10 years for the Horological Methods Engineer. A comparison of work experience, education and training requirements for these nine jobs is presented in Appendix D.

Background Data

The domestic jeweled-lever watch manufacturing facilities constitute a small and highly specialized metalworking industry composed of four companies: Jeweled-lever Watch Company A, Jeweled-lever Watch Company B, Jeweled-lever Watch Company C, and Jeweled-lever Watch Company D. What differentiates the jeweled-lever watch industry from other metalworking activities is that it produces tiny parts to meet highest precision standards and assembles these parts into a highly synchronized unit on a mass production basis. Unlike the Swiss Watch Industry, watch factories in this country combine in one establishment a large number of different types of work needed to produce a complete watch movement.

Watch factories have extensive machining operations which involve the use of a wide variety of machine tools. These include lathes, screw machines, gear hobbers, and special purpose machines. Although basically Swiss models, many of the machines are American made or have many American devised improvements. To maintain these machines and to produce jigs, fixtures, and dies, the plants have sizeable tool and die departments. In addition, the industry produced springs, beginning with the basic strips of especially designed alloy metal which are tempered and burnished to meet the exacting standards for watch springs.

In the assembly divisions of the plants, generally the watch parts are brought together first in sub-assemblies of the movement such as balance assembly, wheel assembly, and escapement unit assembly. The sub-units are assembled on the chassis. The movement is set into the case and the face and hands are attached. The watch undergoes a series of inspections and adjustments in the course of the parts manufacture, the assembly of the various units, and finally at completion.

It is the contention of the domestic industry that production of jeweled-lever movements has declined to the point where it may no longer be profitable to continue production. It is claimed that in that eventuality, key skills essential to the national defense effort will be lost. Such skills, it is further contended, will not be available elsewhere because of the uniqueness of the tolerances and workpiece dimensions dealt with in the industry.

Trends in Employment and Production

Total employment in the jeweled-lever watch industry has been declining in recent years. In September 1956 the industry had 7,524 employees, 22 percent less than in June 1954, 29 percent fewer than in September 1952, and 39 percent less than in September 1948. Table 1 provides information on employment in the industry for one month each year (except for 1955) in the period 1948-56, as collected by the special surveys made by the Bureau of Labor Statistics. Average annual employment in the industry as reported to the Tariff Commission is given in Table 4.

There was a significant change in the occupational structure of the industry in recent years as can be seen in Table 2. Whereas total employment in the industry declined 29 percent between September 1952 and

September 1956, the number of skilled horological workers declined about 18 percent and the number of key professional technical workers increased by 12 percent. The large decrease in employment occurred among the semi-skilled and less skilled personnel where employment fell by about 39 percent.

The changed pattern of the industry's occupational distribution is related to several factors. One of these is the decrease in the importance of defense type production. Defense type work requires a smaller proportion of skilled horological workers compared to watchmaking. A second factor is the industry's increasing emphasis on research and developmental work which has resulted in professional and technical workers making up a higher proportion of total employment. Between September 1952 and September 1956, for example, the number of key professional and technical employees increased from 306 to 344 with the increase mainly among engineers and other technical workers. This increase occurred at the same time that total employment was declining by 29 percent. (These figures do not fully reflect the use of engineers and other technical workers in horological research because two of the jeweled-lever watch companies have research facilities separate from their manufacturing establishments. These separate research facilities are not included in the industry's employment total.) A third factor affecting the occupational distribution of the industry is the changing technology in watchmaking which is discussed later in this report.

The output of jeweled-lever watch movements in the United States in 1956 was 23 percent higher than in 1954, although 14 percent below the 1952 level as can be seen from Table 4. The 2,112,000 jeweled watch movements produced in 1956 was much above the 420,000 units which the ODM has reported would be needed in the peak year of a mobilization period for both military and essential civilian use.

There are two principal factors which made it possible to have a substantial increase in jeweled watch output between 1954 and 1956 at the same time that total employment in the industry was declining. One was the decline in the industry's ordnance output. As shown in Table 3, for the survey week in 1956, the number of production worker manhours expended on military items was less than one-third of that expended in the survey week of June 1954. In September 1956, about 21 percent of the industry's production worker manhours was spent on military products and 79 percent on civilian products. By comparison, in June 1954, 57 percent of production worker manhours was devoted to production of military items.

The other factor is the growing output per worker in watch manufacturing. Table 4 provides information collected by the Tariff Commission, giving annual statistics on output of jeweled watch movements and the average number of workers employed in producing these movements. No study of productivity in watchmaking was carried out in connection with the BLS study. However, the Tariff Commission data which show that a 40 percent decline in employment occurred with only a 13 percent decrease in the number of watch movements produced between 1952 and 1956, must be considered indicative of the increasing output-per-worker rate in the industry. 1/

Plant visits and discussions with industry and union officials indicate several important technological changes affecting watch output per employee now taking place in the industry. One is the greater production of watch parts per machine operator. This is due in part to improvements in the machines used in parts production and the better use of plant facilities permitting an operator to handle more machines. A second factor is the further development of the assembly line technique in watchmaking. Increasing output has apparently resulted from the replacement of some all around watchmakers and adjusters by specialized personnel who perform only a few operations but are able to perform each operation more rapidly.

1/ The data given for the different years may not be fully comparable and as a result cannot be considered a fully adequate measure of changes in output per worker. This lack of comparability may be caused by a number of factors such as changes in product (different watch models) shifts in the quantity of watch parts purchased from outside U. S. industry and differences in the number of workers employed in research.

Mobilization Manpower Requirements

A principal objective of this study was to estimate the manpower requirements of the industry in a mobilization period, particularly the requirements for key skills. This was done by translating into manpower terms the production requirements provided to the Department of Labor by the Office of Defense Mobilization from estimates prepared by the Department of Defense in its "M-day" allocations to industry and ODM's estimate of essential civilian needs. The manpower estimates given here conform to the Defense Department's three-year phased production program.

These manpower estimates do not cover work that would be performed on any special research and development projects that might be awarded to companies in the industry since they were not included in the Defense Department's allocation to the industry. However, since these manpower translations are for workers that would be needed to produce a given volume of military goods, some allowances were made for developmental work carried on in connection with the production allocations. These estimates do not include any employment that would be expended on essential subcontracting done for other firms. (In previous mobilization periods, jeweled watch firms have engaged in the production of precision parts on a sub-contract basis for firms in other industries.) The manpower requirement estimates are based on an assumed 2,400 hour work year (a 50 week 48 hour work week per year). A longer or shorter work week would, of course, change the manpower requirements estimates.

Table 5 provides estimates of total manpower requirements and requirements for individual occupations for each of the three years of the mobilization program. In the first year of the mobilization period an estimated 2,925 (exclusive of general administrative and sales personnel) would be required, about 40 percent of the number employed in the industry in September 1956. The number of workers needed would expand sharply in the second year to an estimated 7,475 and continue to grow to a peak of 8,000 in the third year which is somewhat higher than the September 1956 employment.

The mobilization production estimates have a relatively small requirement for jeweled watch movements. It is estimated that only 750 persons would be employed in jeweled-lever watch production in each of the three years of mobilization.

As a part of this study, an analysis was made of the mobilization requirements for workers in key horological occupations. It was found that the mobilization production program would call for a different occupational structure of the industry than is currently found. Basically, ordnance production requires a smaller proportion of skilled horological workers than does watchmaking. As a result, if a mobilization occurred at the present time, a considerable part of the skilled labor force now employed in the jeweled-lever watch industry would not be needed.

As shown in Table 5 requirements in mobilization for one of the most critical groups in the industry, the foreman, shop masters and other supervisory personnel would be moderately higher than the number employed in September 1956. Only 150 of the currently employed 303 would be needed in the first year of mobilization. But in the second year the number would reach 370 and in the third year a peak of 400 supervisory personnel would be needed.

It is estimated that, at the peak of the mobilization period, about 610 horological machining workers would be needed compared with the 771 employed in the industry in September 1956. Machining workers include tool and die makers, machine tool technicians, and both skilled operators and set-up men of the various machine tools such as screw machines, lathes, and specialized machine tools used in watchmaking. In this group, about 360 machine tool operators, set-up men, and technicians would be needed at the peak of mobilization compared with 454 such workers employed in the industry in September 1956. It is expected that the requirements for tool and die makers, a particularly critical occupation, would amount to 250 at the peak of mobilization. This compares with the 317 employed in the industry in September 1956.

One large occupational group in which fewer workers would be needed in a mobilization period is the watchmaker, assembler, adjuster, and inspector category. At the peak production of mobilization, only about 160 of these workers would be required compared with an employment of

528 workers in this category in September 1956. Although only a small proportion of these workers are directly transferable to ordnance production at their highest skill level, there is no doubt that nearly all such workers could be profitably utilized in a mobilization period. Their experience in handling and dealing with miniature parts and their general "knowhow" in assembling precision equipment make them particularly valuable in manning a mobilization program dealing with precision ordnance production. At the peak of the mobilization period, it is estimated that 270 scientific and technical workers will be required compared to the 344 employed in the industry in September 1956.

Watch manufacturing is a highly specialized operation, with its own unique technology requiring a distinctive body of skill. In estimating the industry labor skill requirements in mobilization, this report has concerned itself primarily with workers in key technical and skilled occupations. However, the industry, in addition to these key workers, has many workers with relatively narrow specializations who require only a few months training. Singly these latter workers are not critical personnel, but as a group they provide a significant proportion of the industry's labor skill. These workers together with the key technical and skilled manual workers working as a team under the direction of experienced management make up the unique processing units needed to produce jeweled-lever watch movements. Experience shows that the creation of such units is difficult. It is reasonable to believe that it would take years to establish watch manufacturing organizations comparable to those now operating in the United States even if workers with requisite skills were available.

Methodology

Two principal steps were employed in developing the estimates of occupational requirements for mobilization. One was the translation of the mobilization bill of goods into estimates of employment. The second was development of occupational distribution patterns for both watch manufacturing and military products allocated to the jeweled-lever watch industry. The occupational patterns developed for the production of watches and for ordnance output were applied to total manpower estimates to obtain the individual occupational estimates.

The volume of the items to be produced each year of mobilization was obtained from the ODM. The labor time for each principal item to be produced in a mobilization period was derived through the use of data furnished by each of the firms in the industry together with data and analysis from previous studies of the industry made by the Bureau. The total watch and ordnance man-hour figure was then translated into 2,400 hour work years to obtain estimates of man years of employment.

The method employed to develop the occupational estimates is based primarily on the principle of characteristic occupational distribution patterns. It is assumed that in our economy a particular set of occupational skills is required to produce a given item of goods. This occupational pattern is generally determined by the processing technology, type of equipment used, the volume of production, the nature of the raw materials, etc. Consequently, an occupational pattern can be developed which is characteristic of the manufacture of a given product. Such occupational patterns were prepared for watchmaking and for ordnance products made in the jeweled-lever watch industry, on the basis of a survey of employment by occupations for principal products, conducted by visits to each of the firms in the industry in December 1956 and January 1957. This survey supplemented previous surveys carried out in the industry from which occupational patterns had been developed.

In addition to the type of analysis described above in making occupational estimates, other techniques were utilized to estimate the requirements for engineers and other technical employees. This was necessary because it is difficult to pin-point the exact place in the manufacturing process of many of these personnel and to determine the amount of technical services that would be required in a mobilization period. Therefore, the relationships of technical personnel to other employees and volume of production as found in other industries were also considered in estimating mobilization requirements for such workers.

Limitations of the Estimates

The accuracy of estimates of total employment and the number of workers by important occupation that would be needed by the jeweled-lever watch industry in a mobilization period is subject to some limitations. The estimates were based on data on workers employed in the industry in 1956 and in earlier periods such as 1952, the early part of the Korean conflict. The estimates were arrived at partly by projecting statistical information and from judgments based on knowledge of the watch technology and the kinds of products that the industry will be called on to make in a mobilization period.

The estimates are therefore subject to revision, depending on the possibility of changes in jeweled-lever watch industry technology and changes in the industry's product which may occur over the years. For example, a significant error would occur if watches with electronic elements should become important by the time the mobilization period occurs. This would result in a significant change in the type of watchmaking skills used in the industry. As a result, estimates of watchmaking skills based as they were on 1956 technology would be inadequate to realistically describe the mobilization period.

Similarly, the product requirements from the industry in a mobilization period are under constant revision, reflecting changing concepts of war and national defense developed by the Defense Department. As a case in point, the type of products that the jeweled-lever watch industry was called on to produce in the Korean conflict was very different from the products it had been told it would be expected to make before the war started. A different bill of goods for mobilization thus would call for different employment and labor skill estimates.

Table 1

Employment in the Jeweled-Lever Watch Industry
1948-1956 (except 1955)

Year 1/	Total
1948	12,268
1949	10,528
1950	8,613
1951	10,462
1952	10,557
1953	11,521
1954	9,624
1956	7,524

1/ Week ending nearest September 15, for each year except 1954 which was for week ending June 12.

Source: Survey of Watch and Clock Companies, November 1952, October 1953, June 1954 and September 1956.

Prepared by: Division of Manpower and Employment Statistics,
Bureau of Labor Statistics
U. S. Department of Labor

Table 2

Employment in Selected Occupational Categories
in the Jeweled-Lever Watch Industry:
September 1952 and September 1956

Occupation	Total employment Sept. 1956	Total employment Sept. 1952	Percent change from 1952 to 1956
Total employment	7,524	10,557	- 28.7
Technical & scientific workers	344	306	+ 12.4
Engineers	187	155	+ 20.6
Mechanical	115	77	+ 49.4
Industrial	29	29	--
Electrical	9	10	- 10.0
Chemists	16	20	- 20.0
Scientists (other)	12	17	- 29.4
Laboratory technicians	50	25	+100.0
Electronic technicians	11	14	- 21.4
Draftsmen	39	59	- 33.9
Other technical workers	17	8	+112.5
Foremen	303	384	- 21.1
Skilled manual wkrs. (horological)	1,492	1,825	- 18.3
Machine shop	771	857	- 10.0
Machine operator and set-up	354	358	- 1.1
Machine tool technicians	100	139	- 28.1
Tool and die makers	317	360	- 11.9
Coordinate measuring mach.tech. I-II	16	20	- 20.0
Watch adjuster, I-III	126	249	- 49.4
Watch assembler, I	175	252	- 30.6
Watch assembler inspector, I	88	133	- 33.8
Watch hairspring assembler, I	73	104	- 29.8
Watchmaker, I-III	66	123	- 46.3
Other skilled horological workers	177	87	+103.4
Semiskilled workers (horological)	798	1,719	- 53.6
Less skilled workers (horological)	2,121	3,035	- 30.1

Source: Survey of Watch and Clock Companies, November 1952 and September 1956.

Prepared by: Division of Manpower and Employment Statistics
Bureau of Labor Statistics
U. S. Department of Labor

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Table 3

Manhours Expended for Defense and Civilian Production
in the Jeweled-Lever Watch Industry --
1948-1956 (except 1955)

Year 1/	Production worker manhours expended on--					
	Total		Defense Items		Civilian Items	
	Number	Percent	Number	Percent	Number	Percent
1948	452,908	100.0	557	.1	452,331	99.9
1949	354,577	100.0	3,898	1.1	350,679	98.9
1950	287,701	100.0	7,152	2.5	280,549	97.5
1951	376,720	100.0	43,198	11.4	333,522	88.6
1952	354,245	100.0	110,343	31.1	243,902	68.9
1953	388,517	100.0	173,665	44.7	214,852	55.3
1954	289,776	100.0	163,936	56.6	125,840	43.3
1956	251,840	100.0	52,071	20.7	199,769	79.3

1/ Week ending nearest September 15, for each year except 1954 which was for week ending June 12.

Source: Survey of Watch and Clock Companies, November 1952, October 1953, June 1954 and September 1956.

Prepared by: Division of Manpower and Employment Statistics
Bureau of Labor Statistics
U. S. Department of Labor

Table 4
Employment, Watch Movement Production, and Output
Per Employee Jeweled-Lever Watch Industry: 1936-1956

Period	Total employment annual average	Average number of employees on watches and parts	Output jeweled watch movements (in thousands)	Output per employee
Av. 1936-40	6,649	6,473	1,678	259
Av. 1941-45	9,999	7,572	1,602	212
Av. 1946-50	9,506	9,318	2,475	266
1951	9,842	8,379	3,162	377
1952	9,951	6,561	2,433	371
1953	10,709	5,951	2,365	397
1954	9,554	4,199	1,716	409
1955	8,010	4,072	1,926	473
1956	N.A.*	3,944 1/	2,112	535

1/ Preliminary

Source: United States Tariff Commission, Watch Movements, July 1956, and preliminary estimates given March 1957.

*Not available.

Table 5

Estimated Overall Manpower Requirements and Number of Workers in Key Occupational Categories in 3-year Phased Mobilization Program for the Jeweled-Lever Watch Industry 1/

	Employment by type of production									Employment September 1956
	First year of mobilization			Second year of mobilization			Third year of mobilization			
	Total workers	No. of workers for watches	No. of workers for ordnance	Total workers	No. of workers for watches	No. of workers for ordnance	Total workers	No. of workers for watches	No. of workers for ordnance	
Total employment 2/	2,925	750	2,175	7,475	750	6,725	8,000	750	7,250	
Technical & scientific workers	180	20	160	265	20	245	270	20	250	344
Engineers	105	15	90	155	15	140	155	15	140	187 3/
Mechanical	70	5	65	110	5	105	110	5	105	115
Industrial	25	5	20	35	5	30	35	5	30	29
Electrical	10	5	5	10	5	5	10	5	5	9
Chemists	5	--	5	5	--	5	5	--	5	16
Scientists (other)	5	--	5	15	--	15	15	--	15	12
Laboratory technicians	20	5	15	30	5	25	30	5	25	50
Electronic technicians	10	--	10	15	--	15	20	--	20	11
Draftsmen	15	--	15	20	--	20	20	--	20	39
Other technical workers	20	--	20	25	--	25	25	--	25	17
Foremen	150	40	110	370	40	330	400	40	360	303
Skilled manual wkrs (horological)	430	240	190	830	240	590	870	240	630	1,492
Machine shop	210	40	170	570	40	530	610	40	570	771
Machine operator and set-up	100	15	85	290	15	275	305	15	290	354
Machine tool technicians	15	--	15	50	--	50	55	--	55	100
Tool and die makers	95	25	70	230	25	205	250	25	225	317
Coordinate measuring mach.tech.I-II	5	--	5	10	--	10	10	--	10	16
Watch adjuster, I-III	30	25	5	35	25	10	35	25	10	126
Watch assembler, I	40	40	--	40	40	--	40	40	--	175
Watch assembly inspector, I	45	45	--	55	45	10	55	45	10	88
Watch hairspring assembler, I	10	10	--	10	10	--	10	10	--	73
Watchmaker, I-III	10	10	--	20	10	10	20	10	10	66
Other skilled horological workers	80	70	10	90	70	20	90	70	20	177
Semiskilled workers (horological)	295	200	95	500	200	300	520	200	320	798
Less skilled workers (horological)	260	115	145	560	115	445	595	115	480	2,121
Workers not peculiar to horol. ind.	1,610	135	1,475	4,950	135	4,815	5,345	135	5,210	1,375

1/ Based on estimated production provided by O.D.M. for military and essential requirements in a mobilization.
2/ Excludes general administrative and sales personnel and related workers.
3/ Includes 34 other specialized engineers.

Analysis of Selected Skills

Scope of Study

In this country, only the four jeweled-lever watch companies previously mentioned are currently able to produce jeweled-lever movements in any significant quantity by virtue of their production tooling and skilled personnel team. On the other hand, there is some intimation that other firms are capable of performing close tolerance work on miniature items. In an effort to establish whether skills considered unique to the jeweled-lever watch movement industry are available elsewhere in the economy a job analysis field study was undertaken by the United States Employment Service of the Department of Labor.

In the early summer of 1956 Department of Labor personnel met with representatives of the four jeweled-lever watch movement companies to decide on the key occupations for which detailed studies would be made. It was agreed to limit the study to a sample of nine representative jobs in order to avoid extensive and lengthy field work. It was further agreed that these jobs would be considered a sampling of watchmaking skills and not an exhaustive listing. The nine jobs proposed by representatives of the jeweled-lever watch companies and agreed to by the group present at the meeting are as follows:

- Automatic-Screw-Machine Set-Up Man
- Diamond-Tool Maker
- Final Inspector
- Hairspring Truer
- Horological Methods Engineer
- Horological Tool-And-Die Maker
- Model Maker
- Watch Adjuster
- Watchmaker

Occupational analysts made highly detailed analyses of all nine jobs in each of the four jeweled-lever watch movement companies in order to establish the bases for which identifications of these skills would be made in other segments of the economy. During their visits, analysts also compiled data from plant personnel records relating to sources of recruitment and training procedures for each of these jobs. Copies of the completed individual analyses were returned to the respective plants where they were approved with only minor changes. Composite analyses, encompassing the data from all four plants, were then developed for each of the nine jobs.3/

The same analysts were then assigned to make similar field studies in 14 other companies 4/ concerned with the manufacture of pin-lever movements or other small precision items.

The selection of companies was done by U. S. Employment Service personnel in cooperation with ODM. The basis of selection was the possible similarity of tolerances and workpiece dimensions to the nine sample jeweled-lever jobs. The purpose of this companion study was to evaluate the similarity of occupational duties, tolerances, workpiece dimensions, and machines used, and to develop data bearing on the transferability of workers from these "related" industries to the jeweled-lever watch movement industry.

Criteria and Limitations

It may be contended that there is no conclusive technique for determining transferability among jobs without actually making such transfers or finding evidence in plant records of such transfers. However, a set of criteria can be established against which to evaluate the transferability

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3/ See Appendix F for sample worksheets used in composite analyses.

4/ A listing of the companies visited and jobs analyzed is contained in Appendix B.

potential of jobs in other industries to the selected key skills in the jeweled-lever industry. The following list of job factors are the ones being used as significant for this purpose:

(1) Work Performed

This includes all duties and job tasks performed including the machines, tools, equipment and work aids used and the materials worked on.

(2) Tolerances

For purposes of this study tolerances include both the specific tolerances required to be attained, and the dimensions of the workpieces on which the tolerances are attained.

(3) Skills and Knowledges

Skills refer to developed or acquired abilities and involve the use of knowledges to perform effectively on the job. Knowledges include the accumulated background information or technical "know-how" necessary to successful performance on the job.

(4) Training Time

Training time refers to the length of time necessary for an inexperienced worker to reach an acceptable level of performance. Included in this job factor are data relating to educational and experience requirements, and the sequence of job experiences required in a worker's progression toward one of the selected, key skills. Training time information is included in this report primarily to provide more complete data for each of the nine sample jobs.

During the course of the field analysis, supplementary data were obtained with respect to such job factors as physical demands, working conditions, and various worker characteristics. Some of this type of information appears as skills and knowledges in subsequent parts of the report, as, for example, the finger dexterity required of Watchmakers and Hairspring Truers. Most of this type of information, however, is not included in the report since it made no significant contribution to the question of transferability of skills.

Data were collected from actual plant records relating to all the previous positions held by workers employed in each of the nine sample occupations. Indications of the duration of employment in previous jobs held were assembled from the personnel records.5/

Questions of job-reengineering, upgrading and job breakdown which would tend to eliminate skill bottlenecks to jeweled-lever production were not specifically considered within the scope of the study. To have inquired into these areas would have required considerably more man-hours of data collection and analysis than it was possible to allocate to the study.

5/ A summary of the total number of such records obtained is presented in Appendix D.

Comparative Analyses of Selected Jobs in Jeweled-Lever Watch Industry with Those in Other Industries

Automatic-Screw-Machine Set-Up Man

Of the fourteen plants sampled, Set-Up Men were identified and studied in eleven of them. Of these eleven plants, five employ Set-Up Men who set up from ten to twenty-five machines for other workers to operate, while the other six plants employ Job Setters who set up and also operate from one to five machines.

Work Performed

The duties and work techniques of the Set-Up Men of automatic screw machines in plants producing pin-lever movements and in plants producing items such as precision bearings, aerial camera parts, and aircraft and electrical instruments are basically the same as those in plants producing jeweled-lever watch movements. All of these Set-Up Men set up Swiss and American automatic screw machines of the same makes. All Set-Up Men install and adjust cams and cutting tools, adjust feeds and speeds, make trial runs, and inspect sample parts for conformity to specifications. The number of cams installed by Set-Up Men found in the eleven plants range from three to as many as twelve and can be compared to a similar range found in the plants manufacturing jeweled-lever movements where up to fourteen cams are sometimes installed. Set-Up Men in the plants manufacturing jeweled-lever movements and in eight plants of the sample (including one manufacturer of pin-lever movements) grind and shape their own cutting tools. Tool Departments perform this function in the other three plants, two of which are manufacturers of pin-lever movements. Set-Up Men in one plant producing jeweled-lever watch movements select and supervise Automatic Screw Machine

Operators. Only two companies of the sample (an electrical instrument company and a manufacturer of precision bearings) have their Set-Up Men select and supervise operators.

Tolerance Limitations and Workpiece Dimensions

The following table compares workpiece dimensions of parts produced and tolerances attained by Set-Up Men in the eleven plants of the sample with those of the Set-Up Men in the plants producing jeweled-lever watch movements.

COMPANY	DIAMETER OF WIRE USED (RANGE)	DIMENSIONS OF SMALLEST PARTS	TOLERANCES ALLOWED
Jeweled-lever Watch Companies	.010" to .79"	Less than .1" length. Diameters .0032".	± .0001" to ± .0004" 4 microinch finish.
Company E	Bar stock and tubing .1[illegible]5" to 3.5".	.141" in diameter; .115" length.	± .002" to ± .004" 25 microinch finish.
Company F	.031" to .375"	.035" in length; .012" in diameter.	.0003" average. 10 microinch finish.
*Company G	Data not available.	Data not available.	Closest tolerance ± .00025" on turned diameters and journals. Normal is ± .0005".
Company H	.020" and up	Pins .032" in length. Diameters .020"; shoulders and pivot widths .006".	.0003" on diameters; .0005" on shoulders. 10 to 15 microinch finish.
Company J	.009" to .625"	.015" in length; .009" in diameter.	± .0005" to ± .001" 4 microinch finish.
Company K	.030" to .79"	Less than .1" length. Diameters .0032".	± .0001" to ± .0004"
Company L	.093" to .562"	1/16" outside diam.; .035" inside dia.	.001" to .002"
Company M	.004" to 2"	.004" diameter; 1/16" in length.	± .0001" to ± .0004" 4 microinch finish.
Company N	Data not available.	Does not make sub-miniature parts.	± .0001"
Company O	.010" to .79"	Less than .1" length. Diameters .0032".	± .0001" to ± .0004" 4 microinch finish.
Company P	.015" to .5"	Screws 200 pitch, .030" diameter. Parts rarely smaller than 1/16" in dia.	± .001" normal; ± .0001" occasionally required. 6 to 8 microinch finish.

* Data obtained from job descriptions only.

Skills and Knowledges

The skills and knowledges required of Set-Up Men in plants manufacturing pin-lever movements, precision bearings, electrical instruments, aerial cameras, and aircraft instruments are the same as those in the domestic production of jeweled-lever movements. Set-Up Men must be able to set up, adjust, and operate several makes of Swiss and American automatic screw machines so that the machines will produce parts to specified tolerances. They must be able to read and interpret blueprints and to visualize the finished parts. They must have a knowledge of working properties of metals, machine feeds and speeds in relation to the metal being machined, and of the limits of the machines.

Diamond-Tool Maker

No jobs comparable to that of Diamond-Tool Maker were identified in any of the fourteen plants sampled which included domestic pin-lever manufacturers, importers of jeweled movements, and manufacturers of precision instruments.

The tolerances to which diamond tools must cut and finish metals in the jeweled-lever industry are the same for all four domestic producers of jeweled-lever movements. Three of these domestic producers currently employ Diamond-Tool Makers. The fourth producer (Jeweled-lever Watch Company D) had previously employed such tool makers to produce precision, diamond cutting and finishing tools. These workers, however, have not been available to the company for some time.

Jeweled-lever Watch Company D currently utilizes the services of Company Q (diamond and carboloy tool manufacturers) for its diamond tool needs. On this basis it was felt that further field analysis work with respect to that job was unnecessary. The fact that Jeweled-lever Watch Company D successfully sub-contracts for such tools was deemed to be sufficient evidence of the existence of these skills outside the industry.

Final Inspector

Of the fourteen plants sampled, the job of Final Inspector was identified and studied in two of them. One plant is a producer of pin-lever movements and the other an importer of jeweled-lever movements. Final Inspectors were found only in plants manufacturing pin-lever and jeweled-lever movements.

Work Performed

The tools, equipment, and work aids used by the Final Inspectors of pin-lever movements and imported jeweled-lever movements are basically the same as those used by the Final Inspectors of domestic jeweled-lever movements. Although the duties and work techniques of the Final Inspectors studied are comparable, there are two differences as follows: (1) The Final Inspectors of jeweled-lever movements examine balance assemblies for faulty functioning roller jewels and pallet stones (jewels), whereas the Final Inspectors of pin-lever movements examine balance assemblies for faulty functioning impulse pins and pallet pins, and (2) the Final Inspectors at one producer of domestic jeweled-lever movements (Jeweled-lever Watch Company B) are required to make repairs to faulty watch movements; Final Inspectors at the other domestic jeweled-lever producers and at the producer of pin-lever movements and the importer of jeweled-lever movements are not required to make repairs to faulty watch movements. These latter companies have malfunctioning movements routed to other departments for correction.

Tolerance Limits and Workpiece Dimensions

The Final Inspectors of domestic or imported jeweled-lever movements examine them for defects in parts, and visually estimate adherence to allowable tolerances ranging from $\pm$ .0006" to $\pm$ .0015". The Final Inspectors of pin-lever movements examine them, using a magnifying projector which enlarges the movement 50 times, enabling measurement against tolerance specifications which range from $\pm$ .001" to $\pm$ .0012".

Skills and Knowledges

The skills and knowledges required of Final Inspectors of pin-lever and jeweled-lever movements are comparable and involve a comprehensive knowledge of the functions of all watch parts and their inter-relationships. In addition, a high degree of finger dexterity is required in order to manipulate tweezers and feelers among small clearances frequently less than .001". However, since Final Inspectors of pin-lever movements (Company O) are not concerned with jewels, a knowledge of jewel clearances in the balance assembly is not required, whereas such knowledge is required of Final Inspectors examining jeweled-lever movements.

Hairspring Truer

Of the fourteen plants sampled Hairspring Truers were identified and studied in four of them. These four plants are concerned with manufacturing pin-lever clock and watch movements. The Hairspring Truers in these plants were compared with the Hairspring Truers concerned with jeweled-lever watch movements. Hairspring Truers were found only in plants manufacturing pin-lever and jeweled lever movements.

Work Performed

The work techniques of hairspring truing used for jeweled-lever movements are the same as those used for pin-lever movements. Hairspring Truers constantly work with loupes and use tweezers to place bends (kinks) in the wire so that the coils will be concentric and will lie in the same plane as the collet and perpendicular to the balance staff. Calipers are used to hold balance assemblies for hairspring truing in both jeweled-lever and pin-lever watch plants. Truers hold the larger hairspring assemblies for pin-lever clock movements between the thumb and finger.

Workpiece Dimensions and Tolerance Limitations

Although one plant making pin-lever movements trues hairsprings comparable in size to those in jeweled-lever movements, the workpiece dimensions found in jeweled-lever watch movements range smaller in size than those in the pin-lever plants studied. The following table lists the plants in which hairspring truing was observed and the typical dimensions of hairsprings that were trued.

Plant	Hairspring Diameter	Wire Thickness	Wire Width	Watch Size
Jeweled-lever Watch Industry	.125"	.00073" to .00295"	.00365" to .009"	20/0 (.533")
Company O	.223"	.0008"	.0011"	8.669 by 10.47 ligne (approx. .77" by .93")
	1/ .139"	.00071"	.0052"	6.777 by 8.016 ligne (approx. .6" by .7")
Company R	.25" to .75"	.00115" to .006"	.005" to .013"	Smallest watch is slightly less than 10 ligne. (approx. .889")
Company M	.375"	.0023"	.0105"	Size data not available - movements used in government timing devices.
Company J	.234"	.0009"	.006"	11 ligne (approx. .978")
	.391"	.0018"	.001"	16 size (1.700")
	.391"	.0024"	.0115"	Used in 8 day clock.

1/ New model scheduled to go into production.

Skills and Knowledges

Hairspring Truers of both jeweled-lever and pin-lever movements possess common skills and knowledges. They must know how and where to make bends (kinks) in hairspring wire and how much pressure or force to apply with their tweezers. They must have a high degree of dexterity to handle small parts and make bends in hairspring wire, using tweezers. Good visual acuity is required in order to judge that coils are concentric and lie in the same plane as the collet and perpendicular to the balance staff.

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Horological Methods Engineer

Of the fourteen plants sampled, jobs comparable to that of Horological Engineers were identified and studied in eight of them. Four of the eight plants are concerned with the production of pin-lever movements. The remaining four plants are concerned with producing precision bearings and precision instruments.

Work Performed

Aside from certain variable duties the basic work activities of the Methods Engineers in plants producing pin-lever movements are the same as those in plants producing jeweled-lever movements. These variable duties are concerned with time and motion studies, transfer of employees, inspection standards, and preparation of job descriptions. However, not all of these variable duties are performed by Methods Engineers in the domestic plants producing jeweled-lever movements.

Of the non-clock and watch plants sampled there were four plants in which the duties of Methods Engineers were essentially the same as those occurring in the clock and watch industry. The primary differences among the Methods Engineers are basically in terms of the application of engineering principles to the problems and technologies involved in producing the specific products made by the various plants sampled.

Skills and Knowledges

The skills and knowledges required of Methods Engineers in the four pin-lever movement plants (one plant is an importer of watch movements that also manufactures automobile clocks) are primarily the same as those required of Horological Methods Engineers in the production of domestic jeweled-lever movements.

Skills and Knowledges - Continued

The Methods Engineers in the clock and watch plants and those in the other industries sampled must have a fundamental knowledge of engineering theory and application, metallurgical theory, tool design, technologies employed by various production departments in the plant, flow of work, and related knowledges, such as heat treating, plating, and cleaning.

The significant differences among the various Methods Engineers studied are in terms of the specialized knowledges and technologies they must have to manufacture the different industrial products with which they are concerned. The Horological Methods Engineer must have a specialized knowledge of watchmaking and horological theory while other Methods Engineers must have specialized knowledges of the technologies and products with which they are concerned, such as precision ball-bearings, aerial cameras, and precision instruments.

Horological Tool-And-Die Maker

Of the fourteen plants sampled the job of Tool and Die Maker was identified and studied in ten of them. Three of the ten plants are concerned with the production of pin-lever movements, one is an importer of jeweled-lever movements and is also engaged in manufacturing automobile clocks and the remaining six plants are concerned with producing precision items, such as bearings, camera parts, and aircraft instruments.

Work Performed

In general, the duties and work techniques of the Tool and Die Maker studied are comparable to those in the domestic jeweled-lever watch industry. The materials, machines, tools, equipment, and work aids are basically the same for all Tool and Die Makers studied even though the plants in which they are employed produce dissimilar products such as, jeweled-lever movements, pin-lever movements, or precision bearings, camera parts, and precision aircraft instruments.

Tolerance Limits

In die layout work, the Tool and Die Makers in domestic jeweled-lever watch companies are allowed a tolerance of within ±.0001" of actual measurement in locating holes. This same tolerance of ±.0001" in locating holes is allowed the Tool and Die Makers in the production of pin-lever movements. The Tool and Die Makers at one company not manufacturing watch movements (Company E), are also allowed a tolerance of within ± .0001" in locating holes, while the Tool and Die Makers at another company (Company L) are allowed a smaller tolerance -- ± .00002". The Tool and Die Makers at the remaining four companies are allowed larger tolerances, ranging from ± .0002" to ± .0005".

Following is a chart comparing typical allowable tolerances used in the fabrication of tools and dies for production of domestic jeweled-lever movements, versus the allowable tolerances used in the fabrication of tools and dies for the production of pin-lever movements and other precision items, such as precision bearings, camera parts and aircraft instruments.

PRODUCERS OF PIN-LEVER MOVEMENTS AND PRODUCERS OF OTHER PRECISION ITEMS

ALLOWABLE TOLERANCES	DOMESTIC JEWELED LEVER MOVEMENT	Company H	Company F	Company N	Company G	Company L	Company J	Company P	Company O	Company S	Company M	Company E
Overall	± .0001" to ± .00003"	± .0002" average	± .0001" average	± .00005"	± .0002"	± .0001" to ± .00002"	± .0001" to ± .00003"	± .001" to ± .003" ± .0001" occasionally	± .0003" to ± .00001"	± .0001" to ± .00003"	± .001" to ± .0001"	± .0001" to ± .00002"
Diameter	± .00005"	± .0003"	± .00005"	No data	No data	± .00005"	± .00005"	± .015"	± .00005"	± .00005"	± .0001"	± .00002"
Center Distances Between Holes	± .00004"	± .0003" to ± .0005"	± .0003" average	No data	No data	± .00004"	± .00004"	No data	± .00004"	± .00004"	± .0001"	± .00003"

Horological Tool-And-Die Maker - Cont.

Skills and Knowledges

The skills and knowledges of the Tool and Die Makers in the production of pin-lever movements and other precision items are comparable to those Tool and Die Makers in the production of domestic jeweled-lever movements. The chief difference appeared in the tolerance limits allowed by the various plants. The knowledge of the operation of all machine shop tools, equipment and measuring devices; the reading and interpretation of blueprints and drawings; the use of shop mathematics; and the knowledge of metal properties are common to all the Tool and Die Makers studied.

Model Maker

Of the 14 plants sampled, the job of Model Maker was identified and studied in nine of them. These include one importer of jeweled-lever movements who also produces automobile clocks, three manufacturers of pin-lever movements, and five manufacturers of other precision items such as cameras, miniature bearings, and aircraft instruments.

Work Performed

In general, the duties and work techniques of the Model Maker studied are comparable to those in the domestic jeweled-lever watch industry. The materials, machines, tools, equipment, and work aids are basically the same for all Model Makers studied even though the plants in which they are employed produce dissimilar products such as jeweled-lever movements, pin-lever movements or precision bearings, camera parts, and precision aircraft instruments. There is one difference in that Model Makers of jeweled-lever movements are also concerned with the installation and adjustment of jewels in the balance assembly, whereas, all the other Model Makers studied have no duties or work techniques involving the installation and adjustment of jewels in the balance assembly of a timing mechanism.

Tolerance Limitations

The following chart compares typical tolerances adhered to by Model Makers in the jeweled-lever, pin-lever, miniature bearing, and precision instrument industries.

Company	Typical Tolerances
Domestic Jeweled-Lever Watch Companies	± .001" to ± .00005"
Company F	± .0002" Average
Company S	± .001" to ± .00005"
Company H	± .0005"
Company J	± .0015" to ± .0001"
Company L	± .001" to ± .000020"
Company M	± .001" to ± .0001"
Company N	± .001" to ± .000025"
Company O	± .001" to ± .00005"
Company P	± .001" to ± .0001"

Skills and Knowledges

The same skills and knowledges are required of Model Makers in the plants producing pin-lever movements as those in the plants manufacturing domestic jeweled-lever movements with the following exception. Since Model Makers working on pin-lever movements are not concerned with jewels, a knowledge of jewel clearances and jewel adjustments in the balance assembly is not required. The Model Makers in the horological industry must possess a knowledge of watchmaking and horological theory, while the Model Makers concerned with other precision items, such as cameras, precision bearings, and aircraft instruments must possess the specialized knowledges required to make working models of the products with which they are concerned.

Watch Adjuster

Of the fourteen plants sampled Watch Adjusters were identified and studied in three of them and compared to the job of Watch Adjuster found in the production of domestic jeweled-lever movements. The only plants in which this job occurs are either importers of jeweled-lever movements or manufacturers of pin-lever movements. No Watch Adjusters were found outside of the clock and watch industry. The following is a summary of the studies and comparisons made.

Work Performed

The duties and work techniques of the Watch Adjusters studied are comparable to those found in the domestic production of jeweled-lever movements. Although the materials, machines, tools, equipment and work aids used by Watch Adjusters working on pin-lever movements were generally the same as those used by Watch Adjusters working on domestic jeweled-lever movements, there were three differences as follows: (1) The Watch Adjusters at one pin-lever movement plant (Company O) used a machine to test the balance wheel for endshake, whereas Watch Adjusters working on jeweled-lever movements tested endshake by lifting balance wheel with feelers or tweezers and estimating amount of clearance. (2) Due to the absence of jewels in pin-lever movements, Watch Adjusters working on such movements did not use special devices, such as jewel staking sets and pallet warmers. (3) In one establishment (Company S - an importer of jeweled-lever movements) the Watch Adjuster had additional tasks usually performed on the assembly line in the domestic jeweled-lever movement companies.

Tolerance Limits and Workpiece Dimensions

The following table compares the tolerance limits and workpiece dimensions worked with by Watch Adjusters of domestic jeweled-lever movements versus those worked with by Watch Adjusters of pin-lever movements and imported jeweled-lever movements.

Tolerance Limits and Workpiece Dimensions - Cont.

Factors Measured	Domestic jeweled-lever movement	Pin-lever and imported jeweled-lever movement		
		Company S	Company O	Company J
*Watch size	.533"	.533"	.77"	.978"
Endshake tolerance	.0006" to .0015"	.0006" to .0015"	.0012" to .001"	.0015" to .003"
4th & center wheel endshake	.0006" to .002"	.001"	**	.0015" to .003"
3rd & escape wheel endshake	.0006" to .0025"	.001"	**	.0015" to .003"

* The size of a watch is determined by its width through the center at the narrowest part of the dial side of the lower plate.

** Company O stated that the necessity for testing train endshake is obviated by close control of piece parts manufacture.

Skills and Knowledges

The skills and knowledges of Watch Adjusters in the three firms studied are similar to those of Watch Adjusters in domestic jeweled-lever movement plants. However, Watch Adjusters working on pin-lever movements are not concerned with jewels, and consequently, a knowledge of jewel clearances and jewel adjustments in the balance assembly is not required whereas such knowledge is required of Watch Adjusters working on jeweled-lever movements. Watch Adjusters must have a knowledge of the functions of all watch parts, their relationship to each other, and the methods and techniques for correcting faulty movements, and the ability to repair and adjust them. All Watch Adjusters studied have the same basic skills and knowledges as those of Watchmakers. Watch Adjusters and Watchmakers are interchangeable.

Watchmaker

Of the fourteen plants sampled, the job of Watchmaker was identified and studied in four of them. The only plants in which this job occurs are either importers of jeweled-lever movements or manufacturers of pin-lever movements.

Work Performed

In general, the duties and work techniques of the Watchmakers studied are comparable to those found in the domestic production of jeweled-lever movements.

Although the materials, machines, tools, equipment and work aids used by Watchmakers working on pin-lever movements were generally the same as those used by Watchmakers working on domestic jeweled-lever movements, there were three differences as follows: (1) The Watchmakers at one pin-lever movement plant (Company O) used certain patented inspection devices such as an end-shake testing machine, whereas, the Watchmakers working on jeweled-lever movements tested endshake by lifting balance wheel with tweezers and estimating amount of clearance. (2) The Watchmakers at the same plant used a "Put Together Block" (a semi-automatic assembling device in which seventeen watch parts can be assembled in one operation) whereas this operation is performed by hand by Watchmakers working on jeweled-lever movements. (3) Due to the absence of jewels in pin-lever movements, Watchmakers working on such movements did not use special devices such as jewel staking sets and pallet warmers.

Tolerance Limits and Workpiece Dimensions

The following table presents a comparison of the tolerance limits and workpiece dimensions used in the production of domestic jeweled-lever movements versus those used in the production of pin-lever movements and imported jeweled-lever movements.

Factors Measured	Domestic jeweled-lever movement	Pin-lever and imported jeweled-lever movement			
		Company S	Company O	Company J	Company M
*Watch size	.533"	.533"	.77"	.978"	.533"
Endshake tolerance	.0006" to .0015"	.0006" to .0015"	.0012" to .001"	.0015" to .003"	.0006" to .0015"
4th & center wheel endshake	.0006" to .002"	.001"	* *	.0015" to .003"	.0006" to .002"
3rd & escape wheel endshake	.0006" to .0025"	.001"	* *	.0015" to .003"	.0006" to .0025"

* The size of a watch is determined by its width through the center at the narrowest part of the dial side of the lower plate.

** Company O stated that the necessity for testing train endshake is obviated by close control of piece parts manufacture.

In bringing a watch to time, the domestic jeweled-lever movement industry allows a variance of ∤ 15 seconds in a 24 hour period, as compared to ∤ 1 to 2 minutes in the same time period among some manufacturers of pin-lever movements. The Watchmakers at Company S and Company M who worked with jeweled-lever movements maintained the same tolerances on the same size workpieces as Watchmakers working on domestic jeweled-lever movements.

Skills and Knowledges

For the most part, the skills and knowledges of Watchmakers concerned with pin-lever movements are comparable to those of Watchmakers concerned with domestic jeweled-lever movements. Watchmakers concerned with either jeweled-lever or pin-lever movements require a knowledge of the functions of all watch parts, their relationship to each other, and the methods and techniques involved in correcting faulty movements. In addition, a high degree of finger dexterity is required of Watchmakers working with either jeweled- or pin-lever movements in order to manipulate small parts with tweezers. Since Watchmakers working on pin-lever movements are not concerned with jewels, a knowledge of jewel clearances and jewel adjustments in the balance assembly is not required, whereas such knowledge is required of Watchmakers working on jeweled-lever movements.

TABLE

Estimates of Training Times Involved in Transferring Workers to Jeweled-Lever Industry

Industry	Sample Jeweled-Lever Movement Jobs								
	Automatic-Screw-Mach. Set-Up Man	Diamond-Tool Maker	Final Inspector	Hair-spring Truer	Horological Methods Engineer	Horological Tool-And-Die Maker	Model Maker	Watch Adjuster	Watch-maker
Pin-Lever Industry	A	*	A	A	A	A	A	A	A
Precision Instrument Industry	A	*	*	*	E	A	E	*	*
Diamond-Tool Industry	*	A	*	*	*	*	*	*	*
Screw-Machine Products Industry	A	*	*	*	*	*	*	*	*

Key
A: Transferable with abbreviated break-in period (up to 90 days).
E: Transferable with extensive training (approximately 1 year or more).
*: Job does not exist in industry. See Appendix D for training-time requirements for inexperienced workers.

Appendix A

DEFINITIONS OF THE NINE SAMPLE JOBS

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APPENDIX A

DEFINITIONS OF NINE SAMPLE JOBS

IN

JEWELED-LEVER WATCH INDUSTRY

AUTOMATIC-SCREW-MACHINE SET-UP MAN:--Installs, adjusts, and repairs cutting tools, cams, gears, chucks, slides, and similar parts of complex Swiss- and American-made machines used to mass-produce precision watch parts, such as wheels, pinions, clicks, and screws: Works from blueprints and uses variety of mechanic's tools and equipment to install and adjust working parts. Test-operates equipment, measures dimensions with precision gages, diagnoses reasons for off-standard product, and adjusts machine accordingly until product is within tolerances, which may be as fine as 0.0001 inch. May teach new operators how to operate machines and maintain setup.

DIAMOND-TOOL MAKER:--Fashions diamond-cutting tools, such as lathe cutters and countersinks used in machining watch parts, using variety of gemcutter's and machine-shop tools: Selects rough diamond of proper crystalline structure and studies structure to determine how best to fashion specified edge. Fits diamond at proper angle in solder in holding tool (dop), positions dop in tang (heavy metal arm), applies diamond powder to surface of lap, and positions this assembly in lapping device so that diamond is ground and polished at specified angle. Mounts diamond-cutting edge in steel holder, using variety of machine-shop tools to cut and slot recess and fasten edge rigidly in place. Exercises knowledge of fundamentals of tool design as well as utilization of industrial diamonds and their characteristics so that strains will not be set up which would result in fracture of diamond tools. Frequently inspects diamond with loupe during processing and positions it at proper angle by eye alone.

FINAL INSPECTOR:--Examines watch subassemblies and completed watch movements to determine that they function accurately: Diagnoses defects. Inspects banking of pallet, and lock, drop, and slide of escapement. Determines that hairspring is level and centered, and inspects and adjusts beat. Tests endshake (vertical play of wheels), using tweezers to determine that it is within acceptable limits (frequently as low as 0.015 mm). Examines spring to determine that it is centered between regulator pins, and centers regulator lever. Examines movement for scratches, and blows out dust or dirt with air hose. Determines accuracy of movement by running it for a specified period in a number of different positions. Oils or inspects oiling of pallet stones and jeweled bearings. Disassembles movement to point of error and replaces defective parts, using a variety of watchmaker's tools. May clean parts with soft leather and polish case with chamois. Observes minute parts with aid of loupe and handles parts with tweezers. May inspect and adjust watches after specific subassemblies have been added, such as barrel, train, and balance.

HAIRSPRING TRUER:--Adjusts hairsprings so that they will be in same plane as collet and concentric with it: Mounts hairspring and balance wheel assembly between jaws of truing calipers. Turns wheel and examines spring with aid of loupe to determine if center coils appear as perfect circles. Bends inner coil of spring away from or toward collet, using tweezers, to locate center of collet in center of spring and to correct errors resulting from faulty colleting of coil. Estimates whether space between collet and first inner coil is within acceptable limits, and bends coil with tweezers to correct errors. Examines plane of hairspring to determine that all coils are parallel to plane of collet, and raises or lowers individual coils with tweezers to correct discrepancies.

HOROLOGICAL METHODS ENGINEER:--Establishes and standardizes production assembly and inspection methods concerned with the manufacture of watches and clocks and timing devices; analyzes production reports to make cost estimates and develops procedures for reducing production costs through improved methods and tooling and in elimination of uneconomical methods; works in intimate conjunction with tool and die makers, foremen, set-up men for the approval of tools and the parts produced from the tools; is responsible for final approval of tools and parts prior to scheduling of production. Responsible for specifying tools, materials, gages, etc., necessary for the manufacture and assembly of parts and composes drawings for each step of the manufacturing and assembly methods procedures.

HOROLOGICAL TOOL-AND-DIE MAKER:--Constructs, repairs, and maintains machine-shop tools, jigs, fixtures, dies, and gages used in manufacture of miniature watch parts: Lays out work according to blueprints, rough sketches, or original designs. Sets up and operates various machine tools and attachments, including lathe, profile grinder, and Swiss jig borer, utilizing a knowledge of handbook formulae, geometry, and trigonometry. Heat-treats finished tools. Gages and measures tools, using manual and visual instruments. Devises new methods, frequently working on items such as shaving dies with concentricity specifications of .0002 of an inch.

MODEL MAKER:--Makes working models of watch parts and complete watches, using a variety of machines, such as model maker's lathe, milling and engraving machines, and jig borer. Makes bridges, plates, and wheels, cutting teeth on wheels and pinions, and working from blueprints to extremely close tolerances. Makes and threads screws. Assembles complete watches.

WATCH ADJUSTER:--Adjusts watch movements to comply with mechanical and timing specifications: Diagnoses defects and makes adjustments such as correcting lock, drop, and slide of escapement; trues balance wheel and hairspring assembly in flat and round and poise balance; corrects overcoiling of hairsprings; and replaces defective parts. Disassembles and cleans movements. Adjusts beat of watch. Observes minute parts with aid of loupe and uses a variety of screw-drivers, tweezers, and other precision watchmaker's tools.

WATCHMAKER:--Cleans, adjusts, repairs, and oils watches: Takes timepiece apart for repairing or cleaning by prying off or unscrewing case, lifting mechanism from case, and disassembling springs, balances, and other parts with the aid of small pliers, screwdrivers, tweezers, and other watchmaker's tools. Examines the various parts, usually through an eyepiece with strongly magnifying lenses, to discover defects, such as broken jewels, improperly fitted escape pinions and wheels, and other faults. Repairs and adjusts timepiece by inserting new mainsprings or hairsprings, resetting pivots, and performing a variety of duties with aid of watchmaker's hand tools and lathe. Cleans timepieces by brushing parts with watchmaker's brush and waste or by immersing them in gasoline, benzine, or other cleaning solutions and drying them in sawdust. Oils timepieces by dropping small amounts of oil on moving parts. Tests timepieces for magnetism and demagnetizes them. Usually repairs clocks, following same procedure as for watches. May perform a variety of jewelry repair duties.

Appendix B

CHART-JOBS ANALYZED IN PLANTS VISITED TO ASCERTAIN RELATED SKILLS

APPENDIX B

Jobs Analyzed in Plants Visited to Ascertain Related Skills

Clock and Watch Companies

Company Visited	Jobs Analyzed: Automatic-Screw-Machine Set-Up Man	Final Inspector	Hairspring Truer	Horological Methods Engineer	Horological Tool and Die Maker	Model Maker	Watch Adjuster	Watchmaker	Diamond Tool Maker 4/	No. of Analyses
Company S (Plant 1)				X	X	X				3
Company S (Plant 2) 1/		X					X	X		3
Company R 2/			X							1
Company J	X		X	X	X	X	X	X		7
Company M	X		X	X	X	X		X		6
Company O	X	X	X	X	X	X	X	X		8
Sub Totals 6	3	2	4	4	4	4	3	4	0	28

1/ Plant 2 consists of a casing and service operation, and administrative office.

2/ The office visited consists of administrative staff only.

4/ Although this job was not found in any of the 14 companies visited, the skill does occur in Company Q which manufactures diamond tools for Jeweled-Lever Watch Company D.

APPENDIX B - Cont.

Jobs Analyzed in Plants Visited to Ascertain Related Skills

Non-Clock and Watch Companies

Company Visited		Automatic-Screw-Machine Set-Up Man	Final Inspector	Hairspring Truer	Horological Methods Engineer	Horological Tool and Die Maker	Model Maker	Watch Adjuster	Watchmaker	Diamond Tool Maker 4/	No. of Analyses
Company E		X			X	X					3
Company F		X			X	X	X				4
Company G 3/		X				X					2
Company H		X			X	X	X				4
Company K		X									1
Company L		X			X	X	X				4
Company N		X				X	X				3
Company P		X				X	X				3
Sub Totals	8	8	0	0	4	7	5	0	0	0	24
Grand Totals	14	11	2	4	8	11	9	3	4	0	52

3/ Data obtained from company job descriptions--plant was not visited.

4/ Although this job was not found in any of the 14 companies visited, the skill does occur in Company Q which manufactures diamond tools for Jeweled-lever Watch Company D.

Appendix C

CHART-NUMBER OF PERSONNEL RECORD DATA SHEETS

FOR SELECTED OCCUPATIONS IN THREE COMPANIES

MANUFACTURING JEWELED-LEVER MOVEMENTS

APPENDIX

Number of Personnel Record Data Sheets for Selected Occupations in Three Companies Manufacturing Jeweled-Lever Movements

Occupation	Total: Number Employed As of Oct. '56	Total: Number of Personnel Record Data Sheets	Watch Co. A: Number Employed As of Oct. '56	Watch Co. A: Number of Personnel Record Data Sheets	Watch Co. B: Number Employed As of Oct. '56	Watch Co. B: Number of Personnel Record Data Sheets	Watch Co. C: Number Employed As of Oct. '56	Watch Co. C: Number of Personnel Record Data Sheets
Automatic-Screw-Machine Set-Up Man	18	23	7	7	7	11	4	5
Diamond-Tool Maker	4	2	1	1	1	1	2	0
Final Inspector	14	14	0	0	11	11	3	3
Hairspring Truer	13	17	3	6	5	6	5	5
Horological Methods Engineer	15	13	1	1	4	4	10	8
Horological Tool and Die Maker	167	138	82	31	66	66	19	41
Model Maker	8	6	2	1	3	5	3	0
Watch Adjuster	(109		0	0	14	17	(*42	20
Watchmaker	(	79	22	5	31	32	(	5
Total	348	292	118	52	142	153	88	87

*Combination employment figure submitted by Jeweled-lever Watch Company C for Watchmaker and Watch Adjuster.

Appendix D

CHART-COMPARISON OF WORK EXPERIENCE, EDUCATION AND TRAINING TIME FOR SELECTED OCCUPATIONS IN THREE COMPANIES MANUFACTURING JEWELED-LEVER MOVEMENTS

APPENDIX

COMPARISON OF WORK EXPERIENCE, EDUCATION AND TRAINING TIME FOR SELECTED OCCUPATIONS IN THREE COMPANIES MANUFACTURING JEWELED-LEVER MOVEMENTS

OCCUPATION AND TYPES OF EXPERIENCE	Jeweled-lever Watch Company A			Jeweled-lever Watch Company B			Jeweled-lever Watch Company C		
	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)
Automatic-Screw-Machine Set-Up Man									
Inexperienced Worker	Shop Math and Machine Shop Courses	4	2	-	-	-	-	-	-
Qualifying Outside Experience	-	-	3	-	-	3 - 4	-	-	-
Qualifying In-Plant Experience	-	-	2	-	-	2 - 3	-	-	3 1/
Diamond-Tool Maker									
Inexperienced Worker	Technical High School or equivalent - 4 years	4	-	High School	-	7 - 8	-	-	-
Qualifying Outside Experience	-	-	2	-	-	2 - 3	-	-	5
Qualifying In-Plant Experience	-	-	-	-	-	5 - 8	-	-	5

1/ Setup men are selected from qualified Automatic Machine Operators according to progression system in effect.

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COMPARISON OF WORK EXPERIENCE, EDUCATION AND TRAINING TIME FOR SELECTED OCCUPATIONS IN THREE COMPANIES MANUFACTURING JEWELED-LEVER MOVEMENTS

	Jeweled-lever Watch Company A			Jeweled-lever Watch Company B			Jeweled-lever Watch Company C		
OCCUPATION AND TYPES OF EXPERIENCE	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	TECHNICAL OR OTHER SCHOOLING REQUIRED	APPRENTICESHIP REQUIRED (Years)	LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)
Final Inspector									
Inexperienced Worker				High School; Watch College $1\frac{1}{4}$ years	-	5 - 6 2/	-	-	-
Qualifying Outside Experience	(This job combined with that of Watchmaker)			-	-	5 - 6	-	-	-
Qualifying In-Plant Experience				-	-	2	-	-	$1\frac{1}{2}$ 3/
Hairspring Truer									
Inexperienced Worker	-	-	3	-	-	2 - $2\frac{1}{2}$ 2/	High School	-	$1\frac{1}{2}$
Qualifying Outside Experience	-	-	3	-	-	$1\frac{1}{2}$ - 2	-	-	- 4/
Qualifying In-Plant Experience	-	-	2	-	-	$1\frac{1}{2}$	-	-	- 5/
Horological Methods Engineer									
Inexperienced Worker	-	-	-	College Degree (Engineering)	-	3 - 5	Degree in Engineering	-	2
Qualifying Outside Experience	B.S. Degree in Engineering	-	10	-	-	3 - 4	Degree plus 6-months' experience	-	$1\frac{1}{2}$ - 2
Qualifying In-Plant Experience	-	-	2	-	-	2	Watchmaker or Skilled Technician	-	$1\frac{1}{2}$ - 2

2/ Although figure is supplied, it is not normal practice to hire inexperienced people.
3/ Final Movement Inspectors are developed through a job progression system in effect in Assembly Department.
4/ Persons with outside experience are not recruited under normal conditions.
5/ Depends on individual's previous experience and skills.

COMPARISON OF WORK EXPERIENCE, EDUCATION AND TRAINING TIME FOR SELECTED OCCUPATIONS IN THREE COMPANIES MANUFACTURING JEWELED-LEVER MOVEMENTS

OCCUPATION AND TYPES OF EXPERIENCE	Jeweled-lever Watch Company A: TECHNICAL OR OTHER SCHOOLING REQUIRED	Jeweled-lever Watch Company A: APPRENTICESHIP REQUIRED (Years)	Jeweled-lever Watch Company A: LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	Jeweled-lever Watch Company B: TECHNICAL OR OTHER SCHOOLING REQUIRED	Jeweled-lever Watch Company B: APPRENTICESHIP REQUIRED (Years)	Jeweled-lever Watch Company B: LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)	Jeweled-lever Watch Company -: TECHNICAL OR OTHER SCHOOLING REQUIRED	Jeweled-lever Watch Company -: APPRENTICESHIP REQUIRED (Years)	Jeweled-lever Watch Company -: LENGTH OF ON-THE-JOB TRAINING OR EXPERIENCE TO REACH NORMAL PRODUCTION (Years)
Horological Tool-And-Die Maker									
Inexperienced Worker	Technical High School or equivalent	4	6	- 6/	6	5 - 6	-	4	6
Qualifying Outside Experience	-	-	2	-	-	2 - 3	-	-	- 5/
Qualifying In-Plant Experience	-	-	10	-	-	5 - 6	-	-	- 5/
Model Maker									
Inexperienced Worker	Technical High School or equivalent - 4 years	8	4	-	6	5 - 6 7/	Watchmaking School Graduate	-	7
Qualifying Outside Experience	-	-	8	-	-	2 - 3	-	-	4
Qualifying In-Plant Experience	-	-	6	-	-	5 - 6	-	-	4
Watch Adjuster									
Inexperienced Worker	(This job combined with that of Watchmaker)			High School; Watch College 1½ years	-	4 - 5 7/	-	-	- 8/
Qualifying Outside Experience				-	-	4 - 5	-	-	-
Qualifying In-Plant Experience				-	-	1 - 1½	-	-	3

5/ Depends on individual's previous experience and skills.

6/ Jeweled-lever Watch Company B does not have a combined job but a separate one for Tool Maker and Die Maker and the data have been combined.

7/ Although data for inexperienced workers are supplied Company states "Impractical to hire inexperienced person (even with Watch College education or outside experience as a Watch Repairman) directly into this job. Only practical way is through normal progression."

8/ Under normal conditions Watch Adjusters and Watchmakers are developed through the job progression system in effect in assembly departments.

COMPARISON OF WORK EXPERIENCE, EDUCATION AND TRAINING TIME FOR SELECTED OCCUPATIONS IN THREE COMPANIES MANUFACTURING JEWELED-LEVER MOVEMENTS

OCCUPATION AND TYPES OF EXPERIENCE	Jeweled-lever Watch Company A			Jeweled-lever Watch Company B			Jeweled-lever Watch Company C		
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Watchmaker									
Inexperienced Worker	Technical High School or equivalent - 4 years	4	5	High School Watch College $1\frac{1}{4}$ years	-	5 - 6 2/	-	-	- 8/
Qualifying Outside Experience	-	-	2	-	-	5 - 6	-	-	-
Qualifying In-Plant Experience	-	-	2	-	-	1 - 2	-	-	3

2/ Although figure is supplied, it is not normal practice to hire inexperienced people.
8/ Under normal conditions Watch Adjusters and Watchmakers are developed through the job progression system in effect in assembly departments.

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84th Congress, 2d Session | SENATE | Report No. 2629

DEFENSE ESSENTIALITY AND FOREIGN ECONOMIC POLICY

CASE STUDY: WATCH INDUSTRY AND PRECISION SKILLS

REPORT

OF THE

JOINT ECONOMIC COMMITTEE
CONGRESS OF THE UNITED STATES

July 18 (legislative day, July 16), 1956.—Ordered to be printed

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DEFENSE ESSENTIALITY AND FOREIGN ECONOMIC POLICY

CASE STUDY: WATCH INDUSTRY AND PRECISION SKILLS

JULY 18 (legislative day, JULY 16), 1956.—Ordered to be printed

Mr. DOUGLAS, from the Joint Economic Committee, submitted the following

REPORT

The following report of the Joint Economic Committee was prepared and approved unanimously by the Subcommittee on Foreign Economic Policy composed of Representative Bolling (chairman), Senators Douglas, Fulbright, and Flanders, and Representative Talle. The findings and recommendations presented are based upon the subcommittee's hearings and study of defense essentiality, using the watch industry as a case study. The report of the subcommittee was approved for transmission to the Congress by the full committee on July 18, 1956, and will be given further consideration during the coming months in connection with preparation for the committee's report on the 1957 Economic Report of the President. Some members of the full committee who are not on the subcommittee wish to point out that while they have approved the transmission of the report to the Congress they do not necessarily agree with all the conclusions of the report.

I. REASONS FOR THE STUDY

The Subcommittee on Foreign Economic Policy was created pursuant to the authority contained in the March 14, 1955 report of the Joint Committee on the Economic Report (pp. 4 and 5). It held hearings in November 1955, reviewing a wide range of considerations affecting our foreign economic policy. During the course of those hearings, limited attention was given to the argument that trade restrictions may be required for reasons of national defense. The testimony received on this subject was in part so contradictory that the ensuing report of the Joint Committee to the Congress on January 5, 1956, stated (p. 28):

> It is also evident that much greater study is required of the very concept of the mobilization base. There is question whether the present tests of defense essentiality reflect realistically the changing nature of war. * * * Differences of opinion among witnesses make clear that further study of these problems is required in the light of new conditions.

The recommendation of the report was (p. 31):

> Further study is required of the whole concept of defense essentiality if it is not to dominate over other necessary factors in trade policy. Not only should impartial criteria be discovered, but the whole concept of the mobilization base in the light of evolving military strategy should be reviewed.

It is important to state the general finding of the subcommittee to the effect (p. 28):

> There is a valid argument in favor of trade restrictions to aid national defense, but the case requires careful qualification.

This makes clear that the problem was regarded by the subcommittee with an open mind combined with a degree of skepticism toward some of the arguments which had been presented up to that time.

The Congress in 1955 made a part of the Trade Agreements Act a section 7 which provided the Office of Defense Mobilization with the authority to advise the President to take such steps as are necessary to modify trade policy as the national defense may require. It is not within the purview of this subcommittee to make a specific study of that piece of legislation. But the law did provide a new rationale whereby some industries, denied other forms of relief from foreign competition, might advance a "national defense" argument as the next resort to the solution of their problems.

The Office of Defense Mobilization to the present time has taken few overt steps to change trade rules. On April 5, 1956, that office announced that it was starting a study, as its first under the authority of the Trade Agreements Act, on the domestic watch and clock industry, with the initial phase of that study limited to the jeweled lever segment of the watch industry. By early May 1956, as many industries had applied to the Office of Defense Mobilization for relief from foreign competition on the grounds of defense essentiality as there were pending applications before the Tariff Commission for relief under the escape clause.

The combination of these events and the continuing interest of the subcommittee made clear the desirability of a study of the defense essentiality arguments being advanced. Previous governmental decisions regarding the watch industry have given rise to such controversy that it seemed a timely and valuable industry to select as a case study.

Accordingly, letters of inquiry on the analytical approach used by various agencies of the Federal Government in studying defense essentiality were sent out, and public hearings were held in the period of June 4 through June 8, 1956, to explore general concepts and the details of microprecision manufacture so important to modern warfare. The Director of the Office of Defense Mobilization appeared before the subcommittee to interpret the views and procedures of the executive branch of the Government in meeting mobilization base problems.

This report summarizes the highlights of those hearings, to bring into as sharp focus as possible the contrasting views of various witnesses, to identify what questions still remain, and the points which it was possible to resolve. This summary of the latter points should not be construed as a prejudging of any actions which the Tariff Commission, the Office of Defense Mobilization, and other parts of the executive branch of the Government, or the Congress may take in the future, for it has not been possible to resolve all doubts in so short an inquiry. But it is our hope that our painstaking review of a considerable body of evidence will ease the difficulties of the several agencies which will have occasion to study our published record of the hearings for the light which they throw on problems of defense essentiality and foreign-economic policy. As Dr. Arthur S. Flemming, Director of the Office of Defense Mobilization, stated:

> * * * I feel that the committee is to be congratulated on developing plans for a hearing of this kind. I am confident that the testimony that has been presented to this committee will be of real help to us in considering various matters that we will be called upon to consider in this area.

The report which follows accordingly concerns itself with an analysis of changing world conditions, the implications for military strategy, and the problems of choosing the right economic environment for the protection of national security. Having offered these observations based on expert testimony, the general principles which emerge are tested against the problems associated with the watch industry. Choosing a specific industry illustrates that general principles can be used in a particular case, but that they are easily obscured in the complexities and irrelevancies which inevitably are associated with any concrete example surrounded by historical antecedents and by strong pressure interests. It is not always easy to identify the national interest.

We have deliberately included in the discussion major points brought forth by witnesses who felt their views should appear in the record even though many of these points relate to side issues and other battles than those of defense essentiality. Their inclusion will suggest the atmosphere within which responsible executive and congressional agencies must make their decisions for the national good.

As persuasive as some of these subsidiary arguments may be to the reader, we will make every effort to keep these points in proper perspective to the whole subject. No directly interested party will be satisfied with our treatment of their favorite views, but we hope others will find this report instructive.

II. Criteria for Defense Essentiality

A. THE NATURE OF POSSIBLE WARS

Although it can be hoped that the terrible costs to human welfare which wars bring can be avoided, ordinary prudence requires that all nations including our own consider the range of potential threats and their implications for national security. It is clear that no one can read the future with accuracy, nor prepare to meet every possible contingency. National strategy, first having in mind basic objectives, therefore, consists of assessing various potential threats and the responses which should be made considering the relative probability of the threats, their relative seriousness to national survival, and the relative costs, broadly conceived, to our national resources and well-being in meeting these challenges.

For purposes of convenience, and symptomatic of the range of economic requirements and policy determinations which may be called for, we can identify (without reference to the likelihood of each occurring) the following alternative conditions of national existence in the modern world:

(*a*) Stable conditions with no likelihood of war as we have known it because of a widespread desire for peace and the means for international guaranties of such peace, including a foolproof system for inspection against danger of surprise attack.

(*b*) No military war, but intensified efforts by competing states or blocs of states to obtain economic, political, and ideological advantage through such means as expanding trade relations, providing foreign aid and investment, and the stimulating of nationalistic ambitions in third countries. Subversion and propaganda efforts are additional devices.

(*c*) Elements of (b), plus civil strife and other localized wars which may represent an economic and social drain, but do not call for use of full-scale mobilization or major weapons.

(*d*) The peripheral war which is still limited geographically, but which requires a fairly heavy commitment of men and materiel, and which may or may not include tactical use of nuclear weapons.

(*e*) General war which engulfs much of the world but which for some reason does not include significant use of nuclear weapons or toxic warfare against the main industrial centers of the contending big powers.

(*f*) Virtually unlimited war with such combinations of thermonuclear, radiological, chemical, and biological attack as seem worth attempting by the contending forces.

Finally, it should be noted, the logistics requirements and economic consequences of several of the foregoing conditions can vary considerably with the geographic areas of the world involved, the identities of the combatants and neutrals, and the scale of operations.

B. DEFINITION OF NATIONAL SECURITY

National security refers to the basic survival of the people of the country and their important institutions. Broadly conceived, we tend to include not only physical existence in the absolute sense but we are also concerned with our spiritual well-being, social welfare, economic prosperity, national sensibilities and such personal comfort as may be important to us.

The national security can be viewed as defended by two general approaches: the first often labeled "continental defense," and the second, "international cooperation." There was a time when the former might have been considered seriously, because there was a possibility of making this continent impregnable against major attack, and commitments to allies were thought merely an added burden. In any case, if we did become involved in foreign wars, our homeland could become the "arsenal of democracy." In fact, of course, nearly all of our wars have involved close relations with other nations for material and moral support.

Now we have frankly and openly adopted the course of international cooperation, both in peace and war, because no other route is offered to us. There is no longer a choice, for changing conditions have made it sheer necessity. Our own vital interests extend into many parts of the world, and the fate of other nations in any case ultimately will affect our own, if they fall under the control of ruthless and ambitious rivals. Outlying bases and allies are necessary in a mutually supporting effort to warn against sudden attack and to stage most effectively any massive counterblow. These same needs for world links are present to guard against and to wage peripheral wars as well as general conflicts. And clearly, if the cold war has turned toward intensified economic competition rather than immediate warfare with military weapons, many international ties are equally crucial.

Let us examine in greater detail elements of concern in defending the nation, whether viewed from the popular though incomplete and impractical continental defense, fortress America, viewpoint, or from the broader view of international cooperation. For clearly, the security of the United States and of other nations willing to live in harmony is of the greatest importance to all of us, and is of the highest concern to this subcommittee. Consistent recognition of the realities of the choices of strategy open to us in turn will have profound effects on the decisions taken to protect the national security.

The national security is defended by the elemental factors of geographic conditions and man-taken measures of protection such as air-warning, internal policing, and various intelligence operations, plus more positive military preparations when force has to be used as an instrument of policy. Oceans, Arctic wastes, and mountain ranges are a part of our geographic defense together with such important facilities as air and naval bases in parts of the world remote from our shores. Similarly, internal policing to maintain law and order must be supplemented by worldwide flows of intelligence information to anticipate and nip in the bud many difficulties before they become unmanageable. Our positive military preparations even in a period of intercontinental bombers and missiles are predicated upon having allies.

Protection of national security is based upon long-term and short-term factors, both of which are important. In a world of rapid technological development and political surprise, the relative importance of different elements is subject to considerable change, and requires constant review. Thus our geographic position and resources may seem to be relatively fixed, but even their roles clearly change. The formerly impassable Arctic has become an air bridge, and rare materials found in remote parts of the earth have assumed a new importance in advanced technology.

Our industry, commerce, and financial system are even more dynamic, and their growing complexity is both a strength and a weakness. The comparative level of technology and availability of manpower skills in competing countries are increasingly important factors in national security. In the short run, it is forces in being which count, but equally important is the long-run assessment of where we are going in our abilities to create the instruments of military power and of peaceful influence. Our political and social institutions are added important elements in national security as are our national spirit and our cultural heritage. Clearly where it is possible to quantity, the absolute levels and the rates of change of these natural and human resources are important to national security; in any event we must consider the adaptability of all tangible and intangible factors which affect our security.

We have said national security relies upon weapons and forces in being, and upon the industrial and manpower base required for logistic support. But true, too, national survival may depend upon many additional elements. As one example, firm roots in American traditions of liberty and individual worth, and a developed, mature philosophy toward life on the part of our people may be one safeguard against destruction of our institutions by subversion or simple neglect. Another example may be found in measures to stimulate the spirit of hope and progress in other countries, through growing economic relations and cultural interchanges, so that the countries whose governments are predicated on individual freedom and worth may develop a feeling of unity sufficient to offset the danger of piecemeal surrender to totalitarianism through loss of hope. We need to encourage economic and cultural relationships with other powers so that their territories, airbases, resources, and manpower do not come under the control of military rivals, and do remain available to the cause of freedom. This would be true either to stave off thermonuclear war or to prevent or win a peripheral war. (No contestant would win a thermonuclear war, even though it could be lost.)

It seems particularly important to repeat and to emphasize that national security is broader than continental defense and military force. Isolation might have been considered once but now almost every policy must be judged in light of our interdependence with the rest of the world for resources, markets, technical advances, and finally for sufficient understanding and good will to refrain from mutual annihilation through weapons of unparalleled danger to the continuance of life on the planet

Indeed it is this broader view of national security which must prevail under the conditions of the modern world that is the justification for the Subcommittee on Foreign Economic Policy making such a study as this. Continental isolation either in peace or war will not work, and this is the balance of judgment which carried us to lend-lease, World War II, the United Nations, the Marshall plan, Greek and Turkish aid, NATO, the Korean war, and the many other programs of the last several administrations. In general there has been bipartisan support for the thesis that a vigorous and growing world economy, with a strong community of interest among nations, represents the best opportunity for the world to avoid war and for this community of nations to be equal to winning wars against aggressor states when they start wars.

C. THE MOBILIZATION BASE

It is a part of national prudence, while hoping for the best, to be prepared for the worst. This is a responsibility of any government which is not to flirt recklessly with national disaster. Some of the measures are immediate in applicability. Others are longer range in nature. Radar and sky watcher warning systems and strategic air forces capable of dealing strong retaliatory blows are obvious immediate necessities. Of longer range importance are measures to keep our total national productive capacity high, as well as able to produce at the time required and in the quantities needed items incorporating the most advanced technology. This objective requires adequate absolute levels and good growth rates in industry, effective research and development, and a fresh flow of manpower highly educated and trained for military and essential civilian activities. With these general principles there can be little disagreement.

The mobilization base concept is not new, but received serious attention at the time of World War I because we were so poorly prepared then by readiness and experience to turn ourselves into an arsenal of production for the Allied cause. In the years that followed, preparedness thinking was carried on by a few specialists until the outbreak of World War II once again made our productive might, located safely across the oceans from the main areas of combat, the factor which turned the tide against the Axis and brought victory. In both of those wars, this country was late to join, and had the opportunity to convert its industry. In the second of the wars, our tools of control and allocation were more highly developed.

It was natural that the experience of these two wars should encourage defense preparations based upon mobilization plans which on signal would allow selected industries to change to the production of military goods, and that logistic planning should become a highly developed science. This study and foresightedness is commendable as far as it goes, but it is not fully adequate to the needs of today. The changes which are occurring are partly technological and partly world political.

Any mobilization base concept must be given constant review if it is to keep pace with changing world conditions and national needs. Clearly, the classes of international existence identified in this report call for different economic prescriptions to meet each one, and it would be the height of foolhardiness to risk destruction of the Nation by simply picking either 1 or 2 possible emergencies, and tailoring all mobilization plans to meeting those limited cases. The obvious answer would seem to be that we must marshall our resources to meet any eventuality. This of course implies that we shall have the time to convert our peacetime industry to the production of war goods, an increasingly unlikely situation. But let us assume this is still possible. Restricting the discussion for the moment to primarily industrial capital and manpower requirements, one can conceive of an attempt to direct resources so that we have a base to meet all possible eventualities.

However, even the strongest nation on earth is limited in its ability to organize itself against all eventualities. We have had to limit our forces in being to the point where the individual branches of the armed services must compete for limited resources of men and materials. Every aircraft designed must make compromises among the factors of speed, range, maneuverability, armaments, navigation equipment, armor, ease of construction and repair. We want to give our crews every advantage, but we forego some improvements. This does not mean that the human crew is regarded as less important than economy. On the contrary, for each potential use for an aircraft, the design represents that compromise which will give the best chance for the plane to accomplish its mission and bring the crew home. An all-purpose, all-protective aircraft could become so heavy as never to leave the ground. The mobilization base concept also must involve compromises. The economy of the Nation, in a sense, does have to be all-purpose, but if it is to be viable, it must be based upon a sound rationale of the tasks to be carried out and the means for accomplishing them. This implies a system of relatives and the necessity for decision making to establish priorities, based not alone on probabilities but upon the seriousness of the consequences of miscalculation.

Consideration of plans for a mobilization base cannot be foregone just because there are conditions under which it might not be important. But it does not follow either that a mobilization base tailored after the pattern of World War II and the Korean conflict can be accepted uncritically. The probability that in a major war the big powers would use nuclear weapons is very great, and cannot be compared with failure to use stocks of poison gas in World War II. No one has found a clear way to distinguish between military and civilian targets in an all-out effort, and no power has the technology yet to blunt a determined nuclear attack sufficiently to save that country's national identity. This is why many students of the problem believe our economic and industrial effort must be based upon a threefold approach, not one of which is the traditional mobilization base concept. One part must be to keep our industrial system so strong, flexible, and expanding that it can help win the economic-political world battle without resort to arms, except as policing actions occasionally put minor demands upon our production. A second part must be to build our forces in being to such a state of readiness as to act as an effective deterrent until workable international controls are accepted. The final part should be a more realistic facing of the immensity of the survival task if unwanted general war should arrive.

Some authorities have hopefully suggested that even if thermonuclear war should arrive, that first destructive phase in which we might easily lose half our population and two-thirds of our industry would still be followed by a "phase two," in which traditional mobilization base planning has a role as we would rebuild our forces to carry a long, conventional war to enemy shores. It is very hard to accept this view as either a fair interpretation of military strategy as it would evolve after thermonuclear attack, or that any industrial preplanning would be able to anticipate postattack needs adequately. The real task for any country which has been exposed to such attack would be to try to save some small part of human civilization for those who survived both the initial attack and the chaos following in the wake of such a breakdown of community services and economic and social life.

D. MANPOWER SKILLS

Perhaps the greatest asset of any nation is its people. No resources, no location automatically give productivity or military defensive strength, particularly as transportation overcomes previous barriers to movement. Numbers of people are important if the labor force is to be capable of manning a diverse and specialized interdependent economic system, and if the military forces are to have their personnel requirements filled. In a military contest between major powers, their absolute population levels, their population pyramids, and their net reproduction rate trends are of significance.

But of overriding significance are the qualities of the people. Their aspirations and their steadfastness are important, together with their native intelligence and their physical fitness. So, too, is leadership, whatever form of government and social organization is adopted. Our interest now, however, centers on the acquired skills of the work force of the population. This is a paramount consideration in an age so dependent upon advanced technology and in which this revolution is proceeding at breakneck pace.

Requirements for skills can be viewed in short-run and long-run terms. In the short run, we must have the pilots and the radar technicians to fill military billets. We must have the production workers with their background of experience and training to perform the current manufacturing and transporting work the economy requires. Recruitment for immediate needs depends upon the availability of people with experience for the more difficult jobs and with good aptitudes for the jobs which take less training.

The long-run meeting of manpower needs is both more difficult and requires a greater ability to foresee complicated relationships among policies. The most critical of the manpower skills are ones which require the greatest foresight to provide. They require the acquisition of a wide range of basic skills and knowledge. Without minimizing the importance of humanistic education, which is important to the preservation of our institutions and our traditions, we must in this context center our attention on scientific and engineering skills. They are the key to continued technological progress, and technological progress may very well determine our national survival. Clearly, we cannot create good scientists or pursue basic research on a crash basis and expect optimum results therefrom. Only long-range programs starting early in the school career, guided by good teachers and supported by proper equipment, are going to yield adequate results. So, too, must basic research be supported without regard to shifting international relations or economic conditions at home. Finally, in the applied field, there must be opportunity for teams of scientific, engineering, and toolmaking talent to work together and to develop capabilities for meeting fresh challenges brought by rapidly evolving technical requirements.

The Joint Economic Committee has studied the problems of automation, and has found that automation is an extension of processes long underway in our industrial society. The newer aspects of automation not only are accelerating productivity in industry, they are also changing manpower requirements qualitatively. Now more than ever, the scientist and the engineer, and the highly skilled tool and die maker are the controlling factors in attaining production goals for advanced military hardware items and essential civilian products.

The rapid obsolescence of existing weapons and equipment, and the great variety of challenges we face all emphasize that no pool of skilled workers can be frozen in a stockpile and then necessarily satisfy the highest priority of national needs. The constant development of versatility and the expanding capability to meet fresh challenges are of greater importance.

This suggests that the business and social environment in which skilled workers find themselves may be important to maintaining and expanding both numbers and skills, as well as providing incentives for performance at a very high level. Our system looks to competition and the desire for material and social well-being as the means for attaining these ends, rather than either compulsion or complacency. We do not threaten people with penal servitude for failure to reach production goals, but neither do we get best results from those largely sheltered from competition. This is parallel to the situation where an industry feeling some pressure from rivals is more likely to be progressive than one which has a guaranteed market. Scientists and engineers are encouraged to work by individual financial incentives, and these should not be neglected. But these professions also require the status and general level of rewards which will insure that some of our best potential talent will elect work in sciences and engineering, and that the highest grade of graduates are available for teaching staffs. We must see that those of high ability have the opportunity as well as the incentive to acquire the training the country needs.

E. GUIDES TO SELECTING CRITERIA

In the preceding subsections of this report there has been brief analysis of the meaning of national security, of the nature of war, of the mobilization base, of manpower skills. Perhaps most of the points made find general acceptability in this country. But general principles need implementation, and then specific and very complex issues must be faced and resolved. This requires both understanding and a machinery for decisionmaking. The understanding must come to the general public and the Congress as well as to those officials of the executive branch who control the particulars of individual situations. Everyone concerned must appreciate the importance of a well-thought-out program of long-run building of national abilities both in industrial capacity and in manpower skills. Everyone concerned must appreciate that policy is based upon balancing requirements, that each choice made will have consequences favorable and unfavorable. The plea for any single program of military or industrial strength cannot be judged alone on its individual merits, but must likewise take into account a very broad range of short-run and long-run repercussions. This is not easy, and usually the repercussions are difficult to identify, which does not in the least minimize their importance.

When this understanding has been reached, probably the most difficult part of the job is done. What remains is to create a machinery for cataloging our requirements and our facilities, and to have adequate statistical and analytical tools in Government and in business for assessing policy alternatives and implementing those selected. The intangible factors should not be neglected. A decision based upon resource accounting alone might not take into account sufficiently dynamic consequences at home or important relations abroad. And certainly policies related to national security, mobilization, and defense essentiality must be coordinated at the very highest levels of Government. Every department must be working from the same premises if the actions of all are to fit into a meaningful pattern.

It seems very clear that there have been obvious conflicts in previous considerations of the problems of foreign economic policy and of national security. There have been conflicting priorities and means used for making policies effective. This is a type of difficulty which must be resolved, for too much is at stake to allow these differences. It is our view that these conflicts can be settled if a proper understanding is attained of the issues. In the watch industry which we have taken as a case study, it is clear that a narrow view of the mobilization base and the broad objectives of foreign economic policy have clashed, and this study is designed to minimize that danger in the future for both that industry and similar ones which will cause dispute as their individual situations are reviewed.

This subcommittee is convinced that a meaningful pattern very definitely must extend beyond any narrow continental defense concept of the industrial mobilization base. National security has broad international aspects both in time of peace if useful trade among nations is to stave off war, and in time of war, if our strategy is not to fight alone, but with allies to share the responsibility for our collective security. Any lingering doubts that we are all involved as a part of the human race must surely have been dispelled by Army testimony in June 1956 that thermonuclear attack on the Soviet Union could result in heavy casualties in Western Europe or the Far East from the fallout. Preserving national security in this kind of world requires the very broadest consideration of all aspects of particular policies.

In effect, as particular industries ask for special treatment in the name of national defense, we must ask ourselves these questions:

(*a*) How unique and essential is this industry to our military strength and are their skills in short supply?

(*b*) Will trade restrictions actually help the industry to keep its skills and does its civilian production aid our defense, or is it seeking a rationale for its own commercial advantage?

(*c*) What repercussions will such restrictions have in other industries; will fresh burdens be thrown on them?

(*d*) What alternative approaches to preserving the capacity of a critical industry have been sought and weighed?

(*e*) Finally, and not least, what will be the repercussions generally on our allies and on other friendly countries whose prosperity is also important to our national security?

III. Watches as a Case Study

A. ARGUMENTS FOR ESSENTIALITY OFFERED BY DOMESTIC JEWELED-LEVER WATCH MANUFACTURING PROPONENTS

(1) *Essentiality of the American watch industry has been well established and does not need further review.* Domestic producer representatives placed in the record copies of selected previous governmental decisions which leave the impression of unanimity of opinion that the watch industry is essential to national defense because of

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its production of horological devices and of precision military equipment. Constant reopening of the question is upsetting to the industry. The view was voiced that the Congress cannot establish defense essentiality criteria, and such matters should be left to the executive branch of the Government.

Subcommittee commentary.—Continued controversy surrounding watches clearly shows this is not a closed matter. We would be neglectful of our responsibilities not to seek an understanding of what is meant by defense essentiality, how it is applied, and what the consequences are of such applications. Congress cannot act intelligently on the wide range of matters delegated to it by the people unless it studies major problems as well as delegating authority to the executive branch.

Other congressional studies have taken a limited view of the problems of the watch industry in keeping with their responsibilities. At no other time has a committee brought together the economics, foreign relations, and preparedness aspects of the industry in a comprehensive study.

The preceding section of this report emphasizes that needs do change, and that constant review of mobilization base priorities is required.

(2) *The interest of the domestic producers of watches in restricting watch imports is primarily patriotic, not commercial.* The combination of defense contracts, other manufacturing, and importation of Swiss watches is sufficient to keep these domestic companies in healthy financial condition. This establishes their present concern with defense essentiality as genuinely patriotic. But the importers with their interest in increased trade are willing to sacrifice the national security. Trade should not dominate over security.

Subcommittee commentary.—We were left with the impression that both domestic manufacturers and importers have an equal concern for the welfare of the United States. Differences of views on both sides seemed compounded of sincere interest in national security which can be advanced in alternate ways, and of commercial considerations which also may be quite respectable. Trade and national security are not necessarily exclusive alternatives, and indeed the preceding section of this report establishes their vital connection.

(3) *Even with the H-bomb, a war could last many, many years.* Nearly all past wars have lasted longer than people expected they would at the time. This emphasizes the importance of the mobilization base and the watch industry as a part of that base.

Subcommittee commentary.—It is not safe to conclude that history always repeats itself. For example, never before has the survival of life on the planet been threatened by weapons of unparalleled destructiveness. Our views on the mobilization base have been presented in the preceding section of this report.

(4) *The watch industry provides a pool of critical skills for defense.* For approximately 200 years the essential characteristics and design of watches have changed very little. They have been made by skilled craftsmen, with many of the production secrets remaining something carefully guarded, to be passed on from father to son. But gradually greater reliance has been placed upon machine production, once the proper design for a particular model and its tools for close tolerance work have been attained. By progressive stages, machine production

has carried watch manufacture closer to what is popularly called automation. Some of the assembly line jobs can be learned fairly quickly by those who show aptitude for the close work entailed. Supervisory, tool adjustment, and related skilled jobs, however, may require several years to acquire, and a handful of most critical jobs in a watch factory are occupied by those with more than a decade of experience. If a new watch plant is to be successful in less than a decade, it requires under today's technology people of long experience in watch production to do the overall designing and coordinating of production for a complete watch. Watch spokesmen claim no other industry can match these microprecision abilities in mass production.

Subcommittee commentary.—There is no doubt that some of the skills of key personnel in a watch factory take years to acquire, but probably not as great a proportion of jobs are truly critical as the domestic producers imply, and job training times can be reduced, if the experience of other industries has any relevance. Most skills are presently acquired by the slow accumulation of experience rather than through carefully organized and intensive instruction by modern techniques. The experience of one watch firm in establishing a branch plant is a case in point. In any event, we recognize that a modern watch factory which takes advantage of the latest production techniques and which is energetic in research and development represents desirable production capacity both for making horological devices and for making other precision items in a national emergency. We are not convinced, however, that such factories are the sole repository of precision skills in industry.

(5) *Watches are needed in war*. We live in an age in which we are governed by time. In transportation, in all military tactical operations, and in most production processes, accurate time is of key importance to the efficient functioning both of our organizations and our machinery and vehicles. Broadly conceived, timing devices include more than wrist watches and clocks: they include a great variety of special mechanisms which rely upon horological principles. The military forces have provided estimated requirements for a variety of watches and clocks, based upon certain assumptions as to the kinds of emergencies we may face. The Commerce Department also has provided estimates on essential civilian uses for watches, such as for civil defense, nurses and doctors, and production workers in factories and mines. Clearly the efficient functioning of our economy in peace and war depends upon a large number of watches and clocks with sufficient accuracy in some uses as to insure close coordination of separate operations. This is particularly true in aviation, railroading, front-line fighting, and naval operations. The British, French, and Soviet Governments recognize the importance of watchmaking by their special efforts to expand their home industries. Furthermore, the industry must produce at a certain level to exceed the break-even point, regardless of the size of critical needs.

Subcommittee commentary.—There is no denying our increasing dependence in peace and war upon timing devices. Particularly in fixed installations, electric clocks are supplying many services formerly provided by mechanical clocks, and for some purposes, electronic radiations, as in the use of loran for navigational information, can replace some previous requirements for mechanical timepieces. The Department of Defense feels that there was some overissue of watches of a higher quality than actually required in World War II, and it now estimates sharply reduced requirements in a possible 3-year war. Foreign governments' decisions to create horological industries are compounded of several elements in addition to defense needs. How we are to fill our needs for watches is discussed later in the report.

(6) *The possibility of jamming electronic fuzes by ECM (electronic countermeasures) makes especially vital the place of the mechanical time fuze which is based upon horological principles of construction.* Proximity fuzes and radar-guided missiles both have been shown vulnerable to a variety of electronic emissions. Therefore clockwork movements for timing and missile inertial guidance are important if ammunition and missiles are to reach the intended destinations and to perform as programed.

Subcommittee commentary.—This is not disputed, but it should be noted that our relative dependence upon electronics of all kinds is growing, and we cannot afford to neglect these versatile potentialities, either. This report has emphasized the speed and variety of technological changes, and new breakthroughs at any point may alter the importance of specific products, so that our whole industrial structure must be prepared to exploit changes.

(7) *The watch industry is an important source for military end items which require precision and skill.* The microprecision skills of the watch industry have found an important place in the production of military component items which require close tolerance work on small pieces. Typical is the work on aircraft instruments, mechanical time fuzes, rear-fitting safety devices, electronic proximity fuzes, guidance components in missiles, and small gyros for a variety of other military purposes. Some watch manufacturing tools are convertible to turning out nonhorological devices, and clearly a skilled work force both on the production line and in the collection of toolmakers, tool designers, and engineers is an important asset for these other tasks, if they are called upon to turn to this work. Some watch manufacturers contend that only watch manufacturers can produce the types of military components assigned to their companies if the job is to be done with precision and speed, in large volume, and at low cost.

Subcommittee commentary.—Watch companies have made notable contributions to national defense production as have many other companies. They should be particularly well fitted to produce several types of microprecision items, particularly of a horological nature. But there is considerable evidence that other companies can produce microprecision items in quantity too, and that their contributions have been equally important to defense. The Department of Defense reported there is no fuze component which is produced exclusively by jeweled-lever watch companies, and only a small part of the total fuze program is currently programed for mobilization assignment to that segment of the industry. The research and development activities of watch companies in the military field are of growing importance and need the same encouragement given similar efforts elsewhere in the economy. It is not clear that watch production as such is making a large direct contribution to the military research; their research divisions tend to be separately organized and staffed.

(8) *It is the wage differential between Switzerland and the United States which makes it impossible for the American watch manufacturing industry to compete with imports, not any technological lag.* One United

States producer who also operates a factory in Switzerland contended that comparing production methods in his two plants, a clear commerical advantage lay with the Swiss plant because of lower wages in Switzerland.

Subcommittee commentary.—All trade is based upon a difference in costs, and absolute comparisons of efficiency are neither practical nor helpful from a national policy point of view. Our reasoning was developed in our report on foreign economic policy of January 1956. This is not to deny that the domestic watch producers do not find Swiss price competition very keen. But this is not in itself a reason for ending this trade until we have found a higher consideration than price competition, namely defense essentiality, should give reason for interfering with the private business system. Despite lower Swiss costs, American manufactured watches are able to compete in some foreign markets.

(9) *Swiss watch exports to the United States are a relatively small part of the Swiss national income, and consequently little harm would be done to that country if the United States takes measures to protect the domestic industry.* In any case, because Switzerland is determinedly neutral, we have little occasion to worry about the repercussions of our policies in Switzerland. The scare talk that higher duties on watches will hurt United States export sales to Switzerland is not based on facts.

Subcommittee commentary.—There is no doubt that Switzerland is likely to remain a neutral. It is also true that the Swiss are a democratic people, and this is a time when such values are especially important. Our only commentary on the effect of reduced imports of watches is to refer to the foreign economic policy report of this subcommittee made in January 1956. Any reduction in imports (dollar expenditures) is likely to have repercussions on exports (dollar receipts), and the burden of trade restrictions is likely to fall upon our export industries.

(10) *The Swiss watch cartel poses a threat to the American manufacturers, and hence harms an essential industry.* American producers of watches contend it is the purpose of the Swiss manufacturers to destroy all foreign production of watches to create a complete monopoly for themselves. If this is the case, and they are successful, the dependence of at least the non-Soviet world upon this tiny neutral country remote from our shores could be a very critical matter. It would take many years to reestablish a jeweled-lever watch industry based on conventional designs. During a war of limited duration it would be almost impossible. A neutral Switzerland would be under no obligation to supply us, and if it were either surrounded or overrun, that production capacity would be lost to us.

The cartel might approach its goal of market domination by several means. It might sell in this country at dumping prices below the regular level elsewhere. Alternatively, it might sell at prices related to production costs appropriately marked up at retail level, but because of the efficiency of the Swiss industry and the translation of costs, including wages, at prevailing exchange rates, they would underprice their American rivals. The cartel could of course try to maintain its prices at artificially high levels, and the Department of Justice has charged it with restrictive practices designed to accomplish this. The cartel has been charged, too, with using its organized ingenuity to find tax avoidance routes around the protection of the American tariff, and these will be discussed in the next subsection of this report. Finally, the cartel is charged with attempts to limit the export from Switzerland of their specialized know-how in the form of plans, machinery, engineers, and skilled workers. All of these possibilities and actualities, the domestic producers charge, represent threats to American security.

Subcommittee commentary.—There is no real evidence that the Swiss have attempted to sell in their most important market at a dumping price and consequently there has been no move to assess antidumping penalties against watch imports. If the Swiss have held their watch prices to artificially high levels, this affords an umbrella of protection to American producers with higher costs. If the Swiss are able to undersell American producers on the basis of efficiency in production, sales acumen, and price advantage brought by exchange rate translations, it is hard to see why this by itself makes the cartel harmful to this country, for these are not factors related to the cartel form of organization. Swiss cartel attempts to limit the export of technical know-how and machinery are more serious charges if the United States industry is less efficient than the Swiss and needs Swiss innovations in order to catch up.

This country does not like the cartel form of organization, but can not dictate to the Swiss in this matter. Many Americans believe that cartels tend to limit production, raise prices, and become backward in product improvement and cost savings. Considering Swiss preeminence in horology, it would be difficult to prove the general complaint in this instance.

We agree that the fate of the American watch industry should be determined by its ability to meet fair competition and by the needs of our people for specialized essential products not available elsewhere. Maneuvers of a foreign organization operating through restrictive practices should not be allowed to determine the fate of American watch production. On the other hand, no convincing evidence to substantiate charges against the Swiss of cartel interference with our defense were presented, and the attempt of domestic watch producers to make this topic the central one of the entire hearings is judged to have had little relevance to the real problems of defense essentiality.

(11) *Watch upjeweling in this country and the importing of quality watches marked "unadjusted" are two means used by importers to avoid taxes levied on imported watches for the purpose of protecting an essential American industry.* The domestic producers of watches feel that the Congress intended that watches of high jewel counts and exceptional precision be made in this country, and for that reason extra duties are imposed on watches which are "adjusted" for accuracy, and a very high duty on all watches with more than 17 jewels is assessed, irrespective of other features. Watch importers on a small scale now, but perhaps potentially on a much larger scale, convert some imported watches to a higher jewel count or add imported self-winding subassemblies to watches which are imported as 17-jewel watches in running order. The domestic producers also contend that modern watch construction methods create watches which no longer need individual adjustment, but are still the equivalent of "adjusted" watches within congressional intent, and they contend therefore that an indeterminate number of adjustment fees should be assessed against these watches upon importation.

Subcommittee commentary.—This would seem to be another matter not particularly germane to the problems of defense essentiality. It is not within the province of this subcommittee to pass on pending bills related to either of these technical matters. Only to the extent that these tax avoidance measures, if they deserve that label, threaten American security can they even be discussed.

Whether upjeweling is, as the domestic producers claim, a way around the law or, as the importers insist, the normal right of any concern to remanufacture after importation is not for us to say. It does seem as if some of the difficulties are an outgrowth of the curious 1930 decision that watches of more than 17 jewels require markedly different tariff treatment, and of the new consumer preference for high jewel counts which has been fostered by high power advertising and by the desire for special features. We found in our investigations no technical reason for drawing this arbitrary distinction.

Similar complexities surround the relation between the congressional intentions on watch adjustments expressed in 1930 and the situation today when advancing technology has made it possible to build a watch which no longer needs as much manipulation for it to keep good time under varied conditions.

If domestic watch manufacturers are convinced that their industry needs protection from foreign competition, their several attacks on importers are consistent with that objective, however diverse the reasons offered. Already they have won the withdrawal of tariff concessions through the escape-clause action of 1954, and have found the results from their point of view did not go far enough to restrict imports. If they can win a processing tax on upjeweled watches, and an indeterminate number of adjustment fees on watches which do not need the type adjustments made in 1930 but which have similar accuracy, they hope to strengthen their market position compared to their importer rivals. Since there seems no opportunity to prove that the cartel has dumped watches here, even though Swiss watches compete in price, they can be pleased to see the cartel attacked for holding up prices and for limiting foreign watchmaking activities of Swiss manufacturers even though these restrictions help much of our domestic watch industry. Now section 7 of the Trade Agreements Act of 1955 offers the opportunity to add a variety of restrictions if the Office of Defense Mobilization and the President can be convinced that national security requires these.

Certainly our watch tariff problems could be simplified if we applied an ad valorem duty on all watches, regardless of jewel count and form of construction or adjustment, perhaps setting absolute lower and upper limits to this ad valorem rate. Such a tariff would not vary so much in its protective effect with changes in price levels, and by setting at least a minimum rate, the work of customs appraisers would be greatly simplified. This would save us from controversies over the present rules, and attention could be refocused on the main issue of whether the industry does or does not need protection, and whether if required this should be done through the tariff or by other means. However, as a practical matter, this is not the time to amend the 1930 Tariff Act.

B. ARGUMENTS AGAINST ESSENTIALITY OFFERED BY IMPORTERS OF WATCHES AND THEIR SUPPORTERS

(1) *Government findings on watch requirements have been inconsistent and inadequately supported by clear-cut criteria.* The escape clause action was supposed to be based upon the faltering commercial position of the industry, but the President seems to have been influenced by the report on defense essentiality of the industry made by the Interdepartmental Committee on the Jeweled-Watch Industry of the Office of Defense Mobilization in the spring of 1954. There are good reasons for being troubled by the logic or lack of logic on the part of that committee in arriving at its decision.

The Department of Defense made a very complete study of military requirements for watches and other products of a military nature produced in part by the jeweled-lever watch companies. The Department of Defense concluded that the need for jeweled-lever watches in any future 3-year war would be nominal, and that if it were necessary, sufficient watches could be stockpiled in advance. This report was not made public until almost a year later, even though the original report was prepared in a way which would have allowed its declassification at the time.

In contrast, the Department of Commerce concluded in its study made for the Office of Defense Mobilization that annual production of at least 3 million movements was required to meet the very minimum of essential civilian needs in wartime. This, it should be remembered, does not refer to direct military requirements. The Department based its estimate on the apparent shortages and inconveniences of World War II, and then scaled upward the estimates on new requirements to match the growth of population and economic activity. It is curious that the Department of Commerce minimum has been exceeded only 2 years in our history.

The Interdepartmental Committee on the Jeweled-Watch Industry seems to have rejected much of what was concluded by the Department of Defense report, but accepted in scaled-down form the Department of Commerce estimates. The Committee finally supported the figure of 2 million movements a year.

This movements figure seems at best a very crude measure without any particular inquiry into the composition of the work force required, the number of watch designs to be produced, the number of companies to be supported, all of which would have a bearing on the preservation of critical skills. In fact, it looks like a compromise figure, roughly equal to the Department of Commerce estimate cut in half and added to the Department of Defense estimate. Now if the Department of Commerce was correct, it was wrong for the Committee to compromise on a lower figure, simply to get agreement. On the other hand, the Department of Commerce presented no evidence that its findings were anything more than a scaling up of purported watch requirements of World War II and the Korean emergency periods. There was no evidence of an analytical process to show whether the production of 3 million watches a year in war would have a deleterious effect on other essential production. If the skills of the jeweled-lever watch industry are so great, it would seem likely that as in previous emergencies, their abilities would be too important to use in manufacturing watches instead of fuzes, gyros, relays, and many other important devices.

While the details of the Department of Defense study were still kept from the public, that same spring of 1954, the new Assistant Secretary of Defense for Supply and Logistics testified that the jeweled-lever watch industry was essential. When the study was finally made public, long after the escape-clause action, it was hard to reconcile the declassified study and the public statement, despite the assurances of the Secretary of Defense that the position of the Department had not changed.

There is left a strong suspicion that the decision of the Interdepartmental Committee was dominated by domestic commercial considerations rather than either defense needs or foreign policy effects.

Subcommittee commentary.—Careful reading of the Department of Defense report on watches of 1954 and the press release of the Secretary of Defense in 1955 makes it hard to accept that the Department has not shifted its position. The report stated, "* * * no special or preferential treatment for the [jeweled-lever watch] industry is necessary." The press release of a year later stated these words meant the jeweled-lever watch industry is equally as essential as the pin-lever industry, both of which are important.

Considering that watches are likely once again to have a low priority for manufacture in light of the reserve already available in stores and private possession and the need for all precision skills in the country for making more critical military items, it would seem better for the Interdepartmental Committee to have studied that aspect of the problem more completely. Then it would be possible to explore whether watch production in peacetime is necessary to preserve a pool of skills needed in war to make devices other than watches. It would be desirable to study whether singling out the watch industry for special treatment would do more to advance the general level of precision skills available in the country than would more general efforts in research and education and training. Certainly it is important to inquire whether special treatment of the watch industry is likely to harm other critical industries in the United States.

(2) *Other producers are equally capable of performing microprecision manufacture essential to defense.* Only the jeweled-lever watch producers in this country are prepared to produce jeweled-lever watches, and it would take many years to start from scratch to manufacture conventional jeweled-lever watches if those plants did not exist. But when one reviews the uniqueness of their skills for doing close tolerance work on small items in general, the evidence is that an increasing number of other firms are also capable simply because there are increasing demands for such products both in time of peace and in time of war. The four jeweled-lever watch companies do not begin to have the space, the machinery, the production line personnel, the skilled toolmakers, or the engineers to carry the total burden of such microprecision manufacture for the Nation. Nor did they ever have in any past period capacity equal to meet needs of today's magnitude. Even if they could be so equipped, the country could not afford to concentrate strategic and vital production to that degree in a few vulnerable plants of a single industry. The Department of Defense has made clear that it does not regard the abilities of the jeweled-lever watch industry in defense production as unique, even though the industry has valuable capacity. No major military production component is made exclusively by the jeweled-lever watch industry, and only a small propor-

tion of total fuze and rear-fitting safety device orders are programed in the future for production by the jeweled-lever watch industry.

Importer spokesmen noted that although evidence was produced for the record which showed that companies other than jeweled-watch producers had production difficulties which in some instances were overcome with help from these watch companies, this was not the whole story. Once new firms mastered unfamiliar production problems, many of them did very well. There was evidence offered, too, that in some instances, the domestic watch companies have been underbid and outdone on defense work by other domestic firms, including plants operated by importers of watches who were able to do well without the benefit of simultaneous domestic production of jeweled-lever watches. Nor did the watch companies volunteer for the record any information about some of their own previous production difficulties and rejection problems while trying to master new products, even of a horological nature. A labor witness did allude to watch company difficulties in producing ships' chronometers, but there was no elaboration in the hearings. What it comes down to is that today the demands for accuracy, speed, and large volume production are very great, and the best of firms are hard pressed to meet requirements.

Also striking is the changing nature of defense needs. Not only have our methods of production moved toward automatic production within tolerances beyond the capability of the individual skilled worker to meet, but the rapid obsolescence of military equipment is presenting fresh challenges. Typical today is growth of miniaturized electronic equipment used in bombs, shells, missiles, and aircraft. In this work, many newcomers and companies outside the horological industry will have important contributions to make to microprecision manufacture. Twenty years ago, it was uncommon for microprecision work to be required outside the horological industry. By World War II, the picture had begun to change, and since that time each passing year is markedly in the direction of such skills becoming more and more widespread.

Subcommittee commentary.—During the hearings, a representative of the jeweled-lever watch industry conceded equal importance to defense for the pin-lever watch and clock industry. The pin-lever industry, according to evidence in the record, like everyone else, seems to have had its share of production triumphs and failures.

We do not want to minimize the importance of microprecision skills in manufacture required for defense purposes. Watch companies have a long tradition of experience in this field, and undoubtedly can do some operations better than their rivals. But at the same time they cannot do everything better, and can be more than matched in a number of vital fields. Emerging technology will pose very great challenges on all manufacturers, whether they are watch companies or clock companies, or outside the horological industry. Some will do well, while others will have production difficulties. Many of the existing engineering and toolmaking teams will continue to be invaluable, but newcomers will be needed, too. Some of their results, if the past is any guide, will give the established concerns a good run for their money.

(3) *There is only a limited need for more watches in war.* A labor representative at the hearings contended that fuze production was the

least important work of the jeweled-lever watch industry, that fundamentally the basis for preservation of the industry was the production of jeweled-lever watches. Obviously, accurate timepieces are essential in many military operations, and the jeweled-lever watch companies are undoubtedly the concerns best able to make such products, although the importance of pin-lever watch production should not be minimized. But the importer representatives questioned whether watches are needed in the quantities implied by domestic watch manufacturers. Granted for the moment that they are, there should be enough watches in the hands of jewelers and in the possession of the public that could be requisitioned to meet any foreseeable needs for watches even in a war lasting several years. Probably enough ships' chronometers are already in storage by the Navy to meet those needs, too. There is a further question of relative priorities. Granted that watches are important to the conduct of war and essential civilian operations, it does not follow that we can afford to manufacture them in wartime. Probably most watch company facilities would be required to fulfill higher priority needs, just as was true during World War II. Swiss production might again be available as it was in that war, because no limited war would be likely to cut off that country. The Swiss are likely to be cut off only in the kind of grand holocaust which would leave in doubt any mobilization plan.

Subcommittee commentary.—It is the ability of the jeweled watch companies to do fuze and other defense work which leads us to suspect that most of their capacity in an all-out emergency would be diverted from watch production. This ability, of course, is shared with other good firms in this country. It would seem that some of the requirements for watches in time of war have not been based on any real assessment of relative priorities as urged in an earlier section of this report. Air navigation requires high accuracy in instruments, but nurses will harm few patients if they use pin-lever watches and electric wall clocks for taking pulses and timing medication. We were impressed by some of the pin-lever watches shown at the hearings. Many of them would provide a sufficient degree of accuracy for most purposes, and are enough cheaper to manufacture that even if they wear out after a few years, their purchase price approximates the cost of cleaning a good jeweled watch, let alone purchasing the jeweled-lever one initially.

(4) *Technical changes in watches will outmode some present concepts of their essentiality.* As has been pointed out, for about two centuries, watches have been altered very little in design, except to make them smaller and thinner and more stylish. Manufacture has changed, and is changing through standardization of parts and automated production. Self-winding watches have been made in Switzerland since 1880, and one American company now makes such watches. Calendar and other special-feature watches are not new, but are of growing popularity. Improvements in pin-lever watches in this country and in Switzerland are opening up new markets of considerable size which are only partly competitive with American jeweled watch production.

Of considerable interest for the future are the potentialities for revolutionary changes in watch design. These changes may be such that much of present watch technology will be of limited significance to the competitive position of different watch companies. Electronic firms not now engaged in watch production may very well have the advantage in the production of new devices of this type. Already one watch company in this country has announced an electric watch, and the witness from another wore an electric watch to the hearings. Testimony from an importer at the hearings suggested the time is not far distant when electric watches may in turn be replaced by purely electronic watches bearing no relation to the present watch mechanisms except to tell time.

Such products are not yet a marketing reality, but there is little reason to doubt that in a few years they will be. When that time comes, any estimates in the watch industry on the size of facilities, and manpower pools required for defense will clearly have to be reviewed. It suggests that the defense contribution of the watch companies which is real is concerned with the production of military end items, not watches. These defense skills should be considered on their own merits, together with similar skills of nonhorological companies which may be judged worth preserving. But the traditional way of producing watches may prove in time of less importance than is true today.

Subcommittee commentary.—It is premature to judge what the specific effect on the watch industry will be of technological changes which are now under development and may come in the future. Certainly these possibilities stress again the importance of versatile and high caliber engineering and tool and diemaking talent. We must be sure that governmental policies encourage this versatility and do not freeze our capacity in processes which will become outmoded.

(5) *All industries become essential in a major war effort.* Any maximum logistic effort will require all the machinery, skill, and experience which can be converted to saving the Nation. Shortages of such talent will be general. It follows that if the defense essentiality argument is to be allowed any one industry as an excuse to interfere with legitimate peacetime trade, so too may all other industries make pleas for protection. If such grants were to become commonplace, we would retreat rapidly into expensive autarky and an unworkable isolation. The pleas of individual industries cannot be taken too seriously because they lack any common set of criteria, and view their own contributions in a parochial way.

Subcommittee commentary.—There is the danger in some quarters that because all industries are essential in war, any and all pleas for trade restrictions might be entertained uncritically. We would not go so far as to believe any part of the Government would be so naive. We need impartial criteria which may help us to find genuine differences in the degree of essentiality on which policy determinations can be made and which will protect the national interest. Every industry feels itself essential to defense because it knows that its facilities would be employed in an all-out emergency. But there must be selectivity on the part of Government in identifying the more critical, bottleneck industries for special treatment, if we are not to abandon the system of market-price allocation of resources (free enterprise) for a centrally controlled and planned society (totalitarianism). The responsibility for substituting bureaucratic judgment for market forces cannot be taken lightly, and defense considerations must be truly overriding.

(6) *A practical test of defense essentiality might be found in the willingness of the Department of Defense and the armed services to*

carry the costs of certain industries, including watches, as part of their military budgets in the form of direct subsidies. There is no reason why consumers should have to pay a high price for watches to support a so-called essential watch industry. Further, if watch industry research on guided-missile components is essential, the costs of such development work should be a part of the military budget, not obscured as part of a minimum base concept of skilled watch workers maintained through trade restrictions. We do not ask duck hunters to subsidize an ammunition program or the owners of television sets to pay the costs of the DEW line radar screen.

Subcommittee commentary.—It is quite likely that fewer military figures would come forward to volunteer that their organizations pay subsidy money for making civilian watches in order to maintain a mobilization base than now come forward with generalized endorsements of essentiality. This may not be the whole answer to the problem, as implementation might prove difficult in some respects, and more study is required. However it is paid, special treatment for an essential industry does have its cost, and if the purpose is to aid defense, it is a defense expense.

(7) *Fresh restrictions on importation of watches justified on the basis of defense essentiality may have repercussions which are overlooked or disregarded by those advocating this approach to solution of domestic watch industry problems.* Most obvious is that a reduction in the value of imports requires adjustments in the balance of payments. Swiss purchasing power is reduced, and will be evident in lower purchases either from the United States or in third countries which deprived of dollar exchange will themselves have to cut purchases from this country. To sustain the level of exports might require a heavier burden of foreign aid to offset dollar earnings lost here. It is the multilateral balance, not just Swiss trade with this country, which is affected.

Secondly, fresh trade restrictions can be followed by reprisals, and it matters little whether these are considered vindictive or merely adjustments to a new situation. There is danger of starting a new vicious circle of mounting controls which could be very damaging to the goal of strengthened economic relations with friendly countries.

Subcommittee commentary.—These points are easy to accept in principle but harder to prove statistically in particular instances because of the complexities of economic and political relations. But we would go a step further. Whether individual acts seem to be justified or not within the limits of consideration reviewing authorities have used, we sense from worldwide editorial comment, travel, and discussion, a cumulative harmful effect which cannot be measured in quantitative form by any regular review process. Our Government's actions on watches, bicycles, and procurement of generators for public power dams have been viewed apprehensively by all our friends abroad even when they were not directly affected by the decisions taken. Aid for the domestic industries concerned may be required, but if it is, a much more determined effort must be made in the future to avoid measures which can only bring comfort to unfriendly rivals.

(8) *Restrictions on imports taken to aid the domestic watch industry will not have the effects hoped for, at the same time that they make trouble for us in our foreign relations and add an unnecessary burden on other home industries and consumers.* The 1954 decision to raise the duty

on imported watches did not solve the problems of the domestic watch industry, nor is there any reason to suppose that further duty hikes or other restrictions on imports would be beneficial. Consumers will not buy expensive domestic watches which lack advanced features in sufficient quantities to sustain a growing American jeweled-watch industry. For the person who owns a quality domestic watch in good working order, and who wants to buy a new watch with self-winding or calendar or other special features, the chances are good that such a Swiss purchase is not competitive with domestic watch products. There are several consequences which follow from these import restrictions, existing and proposed. In very expensive watches the watch movement is a small part of the price anyway, and duty changes will not affect their market appreciably, or if they do, they are such a small part of the total market as not to affect the general prosperity of the domestic producers. In cheaper watches, the market would simply be lost. Many people unable or unwilling to buy an imported watch at a low price for gift purposes will buy products other than watches, or will buy services, to meet their gift needs. The choice in a gift is not always between a $20 imported watch and a $35 domestic watch, but more often between the $20 watch and a bracelet, or a short train trip, or a chemistry set. Furthermore the growth of foreign travel by Americans is becoming so great that there are a very large proportion of people able to buy directly or through a friend a watch purchased outside the United States tariff jurisdiction. Smuggling of watches is not difficult either, and a high duty gives increased incentive for tourists and transportation company personnel to bring back watches for resale in this country.

Subcommittee commentary.—Certainly past restrictions on watch imports have not increased the share of the market held by domestic watch producers, and a heavier tariff burden on the higher jewel count watches may have been a factor in the shift to the importation in larger quantities of cheaper watches causing some difficulties for domestic pin-lever watch manufacturers. This is arguable, but still is indicative of the complicated results of implementing defense essentiality measures. Both a witness from the jeweled-lever watch industry and the Department of Defense concede that pin-lever watch producers are equally essential to defense. So we note that any increase in duties has the tendency to shift a burden to other parts of the economy, parts which may not previously have needed protection. But with their position made precarious, they may be forced to ask for protection, too. If wholesale adoption of such policies were to be the rule, it would be an admission of a policy of virtually complete self-sufficiency which is not in the national interest. Therefore all changes in rates should look beyond the immediate product affected to these other industries. Whether smuggling becomes more of a problem or whether watches are brought back by tourists not only from Switzerland but even from nearby Canada and Mexico, it is probable that many Swiss watches will continue to reach the United States.

(9) *There are several alternatives to trade restrictions which would offer more long run hope for improvement of the position of the American watch manufacturing industry.* Perhaps most important would be a concerted drive to increase horological knowledge in this country. Although watch repairing is taught, there is no university which offers work in the horological sciences, in contrast to Switzerland

where numerous institutions carry on both training and research. The United States industry has been dependent upon Switzerland for many of its tools and technicians and skilled workers, as well as for jewels which are used in watch manufacture.

American actions to restrict Swiss trade in watches increases Swiss reluctance to allow the export of their machinery and technicians not only related to watches but in other advanced fields of technology and engineering as well.

There is the real danger that the American industry, if it feels it will be protected from progressive rivalry abroad, will grow complacent and have even less incentive for keeping up with the Swiss who are the acknowledged leaders in advancing watch technology. American producers might come to expect with each Swiss advance, that they could return to our Government for further protection.

Subcommittee commentary.—The watch companies are now in the process of expanding their military research activities. It might be desirable for them to make more comprehensive plans for horological research as well, if they feel that watch production is an important part of their defense contribution. Swiss cooperation could be important to this effort, and would be more likely to be forthcoming if the present feuding could be ended.

(10) *The real attack by the American producers of watches is not so much upon the Swiss as upon other American businesses.* The importers imply this when they point out that only about 15 percent of the selling price of an imported watch goes to pay for the Swiss movement. The amount paid in taxes to our Government is in excess of the price of the movement. The greater part of the price is spent for the total of delivery charges, taxes, the case, the strap, and various markups by dealers and retailers.

Subcommittee commentary.—This is a minor point, although the small place of the cost of the movement in the retail price of a watch is worth noting. In general though, whether most of the price goes to other Americans or to the Swiss is not particularly germane to the defense essentiality discussion, and should not have too much bearing on trade policy. The subcommittee's discussion of the balance of payments in its January 1956 report makes clear that dollars spent abroad tend to be as useful to the domestic economy as do dollars spent at home, and in fact, if the reason for buying abroad is based on international division of labor, our well-being under peaceful conditions is enhanced. In passing, we note the 15 percent estimate probably understates the typical Swiss share.

(11) *The real basis of Swiss competition is in the superior technology and marketing abilities of that watch industry, not low wages of Swiss workers.* Much of the American industry seems to have stagnated, and concentrated its efforts on winning new trade restrictions or putting research money into defense items rather than better watches. In contrast, the Swiss have made horology a major technical science, establishing many institutes and courses of study devoted to improvement of watches. Most of the major innovations in watch design and in watch production methods have come from the Swiss. Because their workers are among the highest paid in Europe, it is not proper to credit their price advantage to low wages. The Swiss also have tried to market products which people want. They have developed a large new market in low-priced watches which American jeweled-lever

watch companies do not seem interested in developing. They have also developed very expensive watches with advanced features that the public wants and American producers have not been willing to build into their products.

Subcommittee commentary.—Neither the domestic producer view that Swiss labor is cheap compared with ours, not the importer view that this Swiss labor is the highest paid in Europe can be taken as especially pertinent to the decision on essentiality.

More to the point of competitive relations is whether the Swiss turn out products which consumers in this country want and cannot obtain at home either at so low a price or at any price. From an economic point of view there is no reason why our people should not be allowed to buy what they want. It should be noted, of course, that neither the "escape clause" nor the "defense essentiality clause" have any reference to the consumer interest. Escape-clause actions put the interest of the producer ahead of the consumer, and defense essentiality asks the consumer to carry a part of the burden of national defense in higher prices or less desired products.

The subcommittee established its views on comparative wage rates in its January 1956 report on foreign economic policy. It recognized further that a case can be made for the escape clause, but that its use can have undesirable consequences. It is establishing its position on defense essentiality with this report.

(12) *The American jeweled-lever watch industry is prosperous despite its complaints about watch imports, and therefore is not threatened with extinction.* Most if not all of the domestic watch companies have shown a general upward trend in earnings and assets. The company which has had the most difficulties could not blame those troubles on imports, and feels it has made progress in overcoming those other difficulties now. The domestic watch companies may be having trouble meeting Swiss competition in watches simply because they are so busy diversifying their efforts and spreading top management thin over military research and various other outside activities. All of the domestic jeweled-lever watch companies are also engaged in marketing imported watches under their own labels and some sell additionally under the labels of subsidiary companies.

Subcommittee commentary.—Both the importers and the domestic producers seem to be agreed that the American companies will keep their corporate identities and be able to make money. The domestic companies claim they face serious threats from Swiss competition because their share of the market has declined. The importers tried to establish that although watch sales fluctuate, the domestic companies have not lost ground in absolute terms, and that share of the market is a test open to several interpretations, of which the domestic companies have not picked the correct one. Prosperity of watch companies of course may not guarantee their ability to do defense essential work.

C. OBSERVATIONS ABOUT WATCHES AND THE WATCH INDUSTRY

(1) *The significance of jewel bearings in watches*

Although the facts are not new, the hearings did develop some information about watches which are not common knowledge to the public. The importance of very high jewel counts has been exaggerated in the advertising of some watch producers. A finely machined watch is quite likely to have a considerable number of jeweled bearings, which help to maintain the initial performance of the watch. But beyond 15 or 17, in a conventional watch, added jewels have little significance. The remaining points at which they might be placed are not those at which great friction is encountered. And some very poor watches may also have high jewel counts so that this count is not a guaranty of quality. In fact, added jewels, particularly in small watches, may detract from their time-keeping qualities. In any case jewels cost from 2 to 5 cents each and hardly can be much of a factor in the price of a watch.

(2) *Relation of costs of watches to their retail pricing*

The retail pricing of watches bears little relation to the cost or the quality of the movement. Watches with identical movements and with cases and straps that cost substantially the same sell at markedly different prices. This makes it difficult to understand the precise effect on sales of a change in the tariff, unless the tariff rate is prohibitive. This suggests that some importers probably will stay in business short of a prohibitive tariff or embargo, and that the domestic industry cannot expect guaranteed sales through hikes in the tariff, prohibitive or otherwise.

(3) *Statistical assessments of the watch industry and imports*

There is great difficulty in drawing firm conclusions from the statistical claims of either watch importers or American watch producers as to how the market is divided between them and what the effects of various tariff changes have been.

While there is no complete statistical proof that tariff hikes have hurt Swiss sales in this country, still the test of logic would suggest that such increases in duty have cut into the profits of importers and that because the demand for watches has some elasticity, there must have been some cutback in quantity sold, other things being equal. The drop which did occur in sales after the President raised the tariff could have been related to a need to cut inventories in the recession of that year, or might have been a reaction from overordering in anticipation of the escape-clause action, but logic would suggest the longer range effect of the duty in any case would be adverse.

On the other hand, it is not any clearer from the statistics that raising the tariff in 1954 resulted in improvements in the sales of the domestic companies, although they could argue that they would have been in poorer position but for the hike. Improving business conditions in 1955 probably would have brought some boost in sales anyway. Whether it was the tariff or happenstance, the increased importation of pin-lever and Roskopf movements occurred as 17-jewel watches fell. These results again suggest that higher duties on watches for adjustments, and a processing tax for upjeweling would make no measurable contribution to the strength of the domestic jeweled-lever watch industry to aid national defense.

So long as there are several overlapping and only partially competitive markets for watches and no set of existing statistics are capable of measuring the exact components of these markets, it will be possible for the importers and the domestic producers of watches to disagree as to the state of the market, and neither group of claims can be disproven, even though they come to conflicting conclusions. The

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statistical significance of comparisons on share of market are important, though, for they bear on the question of purported Swiss domination. By selecting appropriate series, it is possible to demonstrate either that the Swiss have about 85 percent of the market for jeweled watches, or that they have less than 50 percent of this market (by excluding (a) special feature watches which consumers want and domestic manufacturers are unwilling to make, and (b) cheap watches which may contain some jewels but which in fact in quality and price should be grouped with domestic pin-lever watches, and are noncompetitive with either domestic or imported quality watches).

IV. Conclusions and Recommendations

A. General

1. National security depends upon many factors, not the least of which is a community of economically healthy nations devoted to living in harmony and tied together by mutually beneficial trade.

2. Mobilization thinking must encompass the possibility of many types of wars; each class of possible emergency puts different demands upon the economy. Mobilization thinking must go far beyond outmoded ideas of continental defense to encompass our worldwide interests. Furthermore, it must be adapted to the changing effects of burgeoning technology and shifting international relations.

3. Resources are not great enough to allow for preparations to meet every eventuality; therefore, it is incumbent upon us to allocate our limited resources to meet the highest priority demands based not only on the likelihood of certain events taking place, but also on the seriousness of these events. This suggests different degrees of essentiality for industries in accordance with the priority of their roles.

4. It is safest to assume that never again will we have time to convert our industry over a period of years from a peaceful orientation to a military one; friendly forces in being and supplies ready for use where they will be needed throughout the world should dominate our readiness planning.

5. Thermonuclear war would destroy civilization and possibly mankind everywhere. It must be avoided; but until acceptable controls are available, our primary economic defense effort must include (*a*) immediate readiness to fight such a war as a deterrent to its ever being needed, (*b*) survival measures of shelters, food, medical supplies, microfilmed libraries, self-contained power sources, and other steps to save human life and civilization if such a war should come despite our best efforts to avoid it, (*c*) worldwide containment measures, both economic and military, positive as well as negative, to minimize the loss of our strength through attrition by totalitarian forces which ultimately might encourage resort to a total war of annihilation against us.

6. Wars short of thermonuclear annihilation can best be prepared for and prevented by keeping strong striking forces of naval and airborne units capable of reaching the scene of any peripheral outbreak soon enough to bring it under control before the conflict spreads into general war. Economic support of this effort implies current production and stockpiling of material needed rather than massive conversion of industry; it also implies allies and available overseas bases.

7. If our major effort includes a building of economic as well as military containment measures, the need for using weapons may not arise on any large scale; but such an economic effort implies closer trade relations with other countries free of mutual suspicions of attempts to export depressions or to insulate noncompetitive industries from progressive rivals.

8. The economic strength of our Nation both for peace and war requires continued capital investment in modern plants drawing increasingly upon the new techniques of automation, and backed up by substantial work in basic sciences plus applied research and development.

9. Even more critical is the need for a continuing and growing supply of skilled manpower capable of meeting these new requirements. Wise manpower policies must raise the basic level of skills by proper long-term methods with a minimum use of short-term makeshift solutions which in the future will prove the more costly. We must see that those able to master these skills receive their basic training in proper schools with the best of instructors, providing both a good grounding in key subjects and also a breadth of understanding in and beyond their fields of specialization. This is because adaptable engineering and toolmaking talent now counts for more than slowly acquired production-line skills.

10. National economic and industrial policy must include a system for judging relative degrees of priority and essentiality in those fields where public decisions dominate resource allocation. In the private economy, we rely upon the price mechanism to make these choices as a reflection of consumer interests. In military affairs, pricing devices encourage efficiency but do not answer directly the major strategic questions which require conscious judgment.

11. Freezing neither industrial capacity nor skilled manpower in set patterns is a wise approach to insuring national security even in the narrow sense of continental defense in an age of accelerated technological change.

12. In the very limited number of cases where the balanced assessment of all factors reveals a few industries need special treatment in the name of defense and if these are industries whose manipulation would have international repercussions, the alternative means to aid these industries should be weighed carefully in each individual case.

(*a*) Tariff increases, direct and indirect, should be eschewed for the burden they throw on other industries, on consumers, and on foreign trade essential to our system of world alliances, and for the reduced incentive to the domestic industry to increase its efficiency or improve its products.

(*b*) Quotas have the same disadvantages as tariffs plus the additional difficulties of rigidity in application and favoritism in assigning shares.

(*c*) Subsidies have many of the same effects as tariffs but are likely to throw a smaller burden on consumers and to require budget controls to provide for an annual review of their costs. This latter feature is a useful one.

(*d*) Stockpiling of durable items not subject to obsolescence but difficult to manufacture or to import in time of war represents a solution to some situations. But just as the tariff should not be used to hide a military cost, neither should military stockpiling hide a depressed industry relief cost.

(*e*) Standby facilities have a limited role: existing facilities which cannot be put to current alternate use might be preserved if there is some prospect of their being needed in an emergency; but in industries which depend mostly on a high level of active skills, standby is not a helpful solution.

(*f*) Expanded research and development is something which should be undertaken without regard to temporary shifts in the cold war; only a sustained effort over many years can reap the full benefits of such an approach.

13. Since our involvement in World War II, this country has been committed to a policy of participation in world affairs as the only possible one for a great power in an age of interdependence and of rapid communication over all distances. This requires a foreign policy which frankly and consistently recognizes these realities, and which builds national security not on an outmoded and unworkable continental defense, but rather works actively to prevent war and unrest anywhere in the world, and if war comes works to keep it as far from our shores as possible. This requires our consistent application of principles designed to encourage economic growth and progress throughout all the like-minded nations of the world; whereas a timorous and inconsistent policy with principle sacrificed to temporary expediency will weaken true national security.

14. It is both encouraging and ominous that the Office of Defense Mobilization has announced that the mobilization base is stronger than at any time in our past and that studies for fighting a war which will not touch our shores are virtually complete, but that study of the effects of attack on this country is still in an early stage. This can be paraphrased to mean that we are in better shape to fight the last war than ever before, and this is a charge which has been made against governments and military leaders many times in the past. That such studies have been completed on one kind of war is commendable, but we are disturbed that defense preparations still lag for other classes of emergencies.

15. If the Office of Defense Mobilization were capable of assessing all mobilization requirements speedily and accurately, there would be no necessity for industries to make individual applications to that agency for relief under section 7 of the Trade Agreements Act of 1955, for the ODM already has the authority under that same section to recommend to the President restrictions to meet these needs spontaneously. However, there is something to be said for maintaining an avenue for redress and petition where it is suspected that mobilization decisions are not being made in accordance with recognizable, uniform criteria by the Office of Defense Mobilization and its interdepartmental committees. There is, on the other hand, the real danger that once the way is shown, trade restrictions in the name of defense will really be manifestations of commercial advantage made sacrosanct against criticisms by the aura of patriotic need, even though the real effect is to weaken national security.

B. WATCHES

1. Watches can be made best by firms experienced in their production, and horological devices are widely used in military operations, but finding the best role for watch manufacturing companies and pro-

viding timing devices for the military services do not necessarily bring us to recommending restrictions on importation of watches. Importation can stimulate the ingenuity and efficiency of the watch industry.

2. Watches are not likely to be produced in this country in any war in which Switzerland is cut off from us. Under such circumstances it is likely then that factories in both countries would be destroyed; or, if they were not, certainly our plants would have higher priority assignments to fulfill than the production of watches.

3. Failure to produce watches in wartime is unlikely to cripple us because watch requirements of the military forces even in a 3-year war have been markedly reduced below World War II standards, and essential civilian requirements, even if they are as high as the Department of Commerce claims, could be met by importation from Switzerland or alternatively by requisition from private citizens.

4. Although the concerns that make jeweled-lever watches have almost a unique ability to manufacture quality watches in a short period of time, their greatest contribution is to the general pool of managerial, engineering, and production-line skills in the manufacture of microprecision military end products; this skill is valuable, but it is not unique, for an increasing number of other concerns are showing an ability to work to equally close or closer tolerances, and to develop complex weapons systems employing such components.

5. Protection of the watch industry by trade restrictions in the name of defense is unwarranted because first, it will not be effective in preserving the domestic industry, and second, it represents an undue burden on other industries as well as consumers. The burden on other industries and on the trade of the free world will detract from national security.

6. Attempts to restrict watch imports whether it is done directly by raising duties or indirectly by reinterpreting upjeweling and adjustment rules and by attacking the cartel are likely to have undesirable side effects on our worldwide trade relations and hence on national security far beyond any narrow gain in domestic watch production.

7. Judgments of American interest in the Swiss watch cartel should be in terms of whether it provides our consumers with products at lower prices and of better quality than would home or other foreign producers; we have no valid reason for dictating the form of internal business organizations in a foreign country.

8. Undue emphasis in advertising and in legislation on high watch jewel counts ignores the nominal cost of jewels and small additional benefit if any which jewels in excess of 17 confer to the maintenance of accuracy of a watch; the consequence is complication and controversy in the administration and enforcement of trade rules as well as misleading the public.

9. The 1954 decisions on watches by the Department of Commerce, the Interdepartmental Committee of the Office of Defense Mobilization, and of the President were not accompanied by completely developed analysis of defense essentiality. The industry appears to have been studied in isolation from other industries and any set of recognizable criteria. We urge that new decisions taken this year be supported in the public record with a full analysis of why the decision is taken, regardless of whether that decision is to call for more or less restriction of the watch imports.

10. We do not believe it is correct to emphasize the present figure of 4,000 workers engaged in producing jeweled watches as the measure of essential skills which are being preserved. In the first place, this reveals no fixed percentage of the critical skills requiring long training within the industry; and secondly, it ignores all the thousands of workers employed by watch companies who are doing defense work today. These latter workers are more obviously contributing to defense and maintaining defense skills than those concerned primarily with routine work on conventional watches for the commercial luxury trade. Our goal should be to expand skills, not to restrict trade, for the latter, negative policy will not contribute positively to American strength or world security essential to us.

11. Two-thirds of the large requirement for jewel bearings is occasioned by the number needed to manufacture 2 million watch movements a year. If the watch-movement figure can be questioned as a wartime necessity, then too, the need for jewel bearings may be grossly exaggerated.

Additional comment by Senator Flanders:

> On the whole I conceive the preceding paragraphs to express reasonable conclusions drawn from the testimony. There are, however, additional conclusions which could only have been reached by the visits made to actual watchmaking plants. Of these, the most pertinent seems to me to be the unique skills of the mechanics and technicians on whom the watch industry depends.
>
> In no other industry are to be found mechanics who can build machinery of such small size and precision as is required for the making of watch parts. In no other industry can be found toolmakers who can produce the microscopic cutters, taps, etc., that are fitted into these machines.
>
> The essentiality of such skills will, I believe, become more evident as the months go by. The replacement of the big vacuum tubes by the little transistors, the replacement of large electrical relays by the tiny cartridge type, are leading to more and more compactness in the control mechanisms which are entering into so many phases of defense work. The watchmaking industry is our nursery for these skills. From this standpoint, I conceive it to be an industry essential to the full development of defense equipment.
>
> For many years past I have been disturbed about the lack of enterprise in an industry which 50 years ago led the world in the commercial production of accurate timepieces. In the last 50 years, however, by lack of enterprise it has surrendered this leadership. In my judgment its essentiality alone entitles it to consideration.
>
> While there are general considerations applying to essentiality, yet the case of each product and of each industry must still be considered on its own merits.

Additional comment by Representative Talle:

> I feel constrained to comment on a few aspects of the report.
>
> It is somewhat difficult to comprehend the timorous and despairing conclusion reached by the report in its considera-

tion of the mobilization base. The report states that it is difficult to accept the conclusion that an attack on this country would be followed by a "phase two," in which traditional mobilization base planning would have a role, i. e., we would be rebuilding our economy and our forces to carry on the war with the enemy. The entire approach of the report seems to be that we should do everything to deter or prevent a war. But, if such war should come and if we should be attacked, we should forget what we are fighting for and against whom we are fighting. This is so, the report continues, because if we were attacked we would have to devote all our efforts to try to save some small part of human civilization for those who survive. Presumably those who survive would surrender unconditionally to the enemy.

I would like to point out that when Dr. Flemming testified before this subcommittee he did not in any way disagree with the subcommittee's conclusion that our first efforts after an attack would be devoted to survival efforts. He stated:

"Under such circumstances we must be prepared, during the period immediately following the attack, to provide the resources which would be essential for survival and rehabilitation."

However, at that point, he did not throw in the towel and recommend that we reconcile ourselves to defeat. On the contrary, he continued: "and then, during the second phase, we must be prepared to resume our production of military end items."

Referring to these two "phases" he stated:

"These will not be sharply defined phases.

"(1) For example, during the first phase we should be in a position where, for whatever period of time that phase may last, we can complete the production of at least a few essential military end items—items that might represent the difference between success and failure in that first phase.

"(2) And certainly, whenever the second phase starts, we will still be engaged in survival and rehabilitation activities.

"(3) Nevertheless, primary emphasis during the first phase must of necessity be placed on survival and rehabilitation.

"Each of these phases would require both facilities, equipment, materials, and services in being and the capacity to produce more of them."

In other words, we must have a mobilization base for survival and rehabilitation activities and for the second phase of a war. It is not "either or"—it is "both and." Any other approach is essentially defeatist.

As the subcommittee well knows, the Office of Defense Mobilization acts in cooperation with interdepartmental committees both at the staff and policy levels. All the resources of the Government are put to work in producing data on which judgments are based. Surely it must be apparent that the conclusions of the Office of Defense Mobilization should be given very careful consideration.

I am also pleased to point out that the record shows that the Office of Defense Mobilization has not only concluded that there will be a second phase, but that also it has undertaken several programs to solve problems associated with it which in its words are "incredibly more complicated and less subject to accurate prediction."

I would like to state that in my opinion it would be extremely harmful for and detrimental to the defense of this country if our mobilization base planning were to be predicated on the watered-down concept described in the subcommittee report.

In its conclusion No. 14, the subcommittee states that it is both encouraging and ominous that the Office of Defense Mobilization has announced that the mobilization base is stronger than at any time in our past and that studies for fighting a war which will not touch our shores are virtually complete, but that study of the effects of attack on this country is still in an early stage. It concludes that it is disturbed that these latter defense preparations still lag.

The Office of Defense Mobilization is to be highly commended for the extensive program of expansion and stockpiling which has been undertaken during the past few years under its direction. That our mobilization base is stronger than at any time in our past should be a matter of reassurance to all of us.

Considering the tremendous day-to-day changes which have taken place in the development of nuclear weapons and the relatively short time in which it has been possible to plan and prepare for attacks of this type on this country, the progress and advances in mobilization planning which have been made in this area have been notable.

To test the adequacy of peacetime planning for mobilization, and to provide a training program for the executive reserve, the ODM has been developing mobilization readiness exercises or war games.

In June 1954 an initial test was conducted in connection with the Federal Civil Defense Administration's nationwide Operation Alert 1954. The second test was conducted in November 1954. It was designed as a command post exercise where some 25 to 30 key mobilization agencies tested relocation and communications facilities for 6 hours.

During Operation Alert 1955, the third in this series of exercises was held. Spanning a 3-day period, June 15–17, Operation Alert 1955 was conducted with considerable success. Several thousand key officials and employees relocated during the test.

In April 1956 it conducted a test of a readiness plan, involving mobilization without an attack on this country. This test was conducted in cooperation with all the departments and agencies of the Government primarily concerned and provided a firm basis whereby the agencies can continue to review their programs in the light of common assumptions.

Operation Alert 1956, scheduled to begin July 20, 1956, will be a continuation of this program on a more extensive scale to test our most advanced plans in this area.

In those parts of the report dealing with the case study on the watch industry the subcommittee has reached several conclusions the firmness of which is entirely inconsistent with its own admonitions as to how the relative merits of domestic defense essentiality and foreign trade should be weighed. The report states flatly that trade restrictions on watches in the name of defense are unwarranted and that such restrictions damage national security by hindering our foreign trade and imposing burdens on other domestic industries. In the light of the subcommittee's own advice that mobilization needs and defense essentiality must necessarily be subjects of constant review and that the effects of imports on both foreign trade and the mobilization base must be currently weighed by the high level officials responsible for the conduct of those programs, the decisiveness and simplicity with which we settle the complicated watch question are likely to raise some questions about the soundness of our overall recommendations.

It appears that the 1954 opinion of the ODM's Advisory Committee on the Watch Industry with respect to the necessity for preserving manpower skills was reached, after careful study and consideration of the various national objectives involved, by high level officials of the Departments of State, Defense, Treasury, Commerce, and Labor and the Office of Defense Mobilization—the kind of forum that we have recommended for such purposes. No evidence received by the subcommittee from representatives of these agencies has indicated any change in that finding. Our only Government witness, Mr. Flemming of the Office of Defense Mobilization, was not queried on the past activities of the executive branch on this point. For this subcommittee, without receiving testimony from those agencies, to reach a flat conclusion that that finding was then and is now in error puts this subcommittee in a questionable position.

ODM's Advisory Committee on the Watch Industry is a continuing body charged with the responsibility for current reviews of the effect of imports on the industry from the viewpoint of national defense. Such a review is now in progress so that before long we should have for our consideration the latest facts and defense findings on this complicated subject. The representation on that committee would seem to insure that the results of that study will represent a careful assessment of the various national security considerations for which the departments of the executive branch are responsible. Under these circumstances I believe it is extremely unwise, both from the viewpoint of our own interests and those of the public, to include in our report determinations as to the defense essentiality of the watch industry.

NOTE.—Additional views of Senator Goldwater and Representatives Wolcott and Curtis of the Joint Economic Committee on the above report will be found in appendix III on page 325.

STATEMENT OF MYER RASHISH, BEFORE THE U.S. TARIFF COMMISSION INVESTIGATION NO. TEA-1A-2 (WATCHES AND MOVEMENTS)

* * * * * * *

II

MAJOR DEVELOPMENTS SINCE 1954

I turn to a discussion of the major developments which have characterized the watch industry in the period since 1954. An understanding of these factors is necessary for any accurate assessment of the probable economic effects of terminating the escape-clause rates.

I will cover four topics in this section: (1) Trends in domestic consumption, including changes in domestic production, and changes in the import picture; (2) increases in labor productivity; (3) developments relating to the structure of the companies comprising the domestic-producing industry; and (4) the growth in watch smuggling and the exploitation of the Virgin Islands loophole.

(1) Trends in U.S. watch consumption

First, as to the trends in domestic consumption. Consumption of watches in the United States has growin from a total of 16.2 million in 1954 to 26.1 million in 1963, the highest total in history. There has been a clear upward trend in consumption of watches in the United States over this period. Both domestically produced watches and those containing imported movements have shared in this growing demand.

(*a*) *Growth in domestic production.*—The production of watches with domestic movements rose over the period from 7.4 million units in 1954 to 12.2 million units in 1963, the highest domestic output in the past 15 years and the fifth highest production in the history of the U.S. watch industry.

Most of the increase in production and consumption of watches with domestic movements during the past decade has gone to the pin-lever segment of the industry. It is, in fact, fair to say that domestic production of pin-lever watches has shown a phenomenal growth during this period, despite the steady dwindling of pocket watch sales on which this segment formerly depended.

Domestic production of jeweled-lever watches appears to have remained relatively steady during the decade until very recently when it spurted appreciably as a result of United States Time's entry into the jeweled-lever market. At present, our best information is that domestic jeweled-lever production is up significantly from the 1.7 million units produced in 1954 and is now higher than in any intervening year. In this connection, the statistics which were displayed at the March hearings by Bulova, Elgin, and Hamilton are totally misleading, as the Tariff Commission can ascertain from its confidential files.

Also worth noting is the fact that domestic jeweled-lever production has tended over the years to become concentrated on over-17-jewel and battery-operated movements. Whereas in 1951, 40 percent of the jeweled-lever watch production was in the over-17-jewel category, by 1959, it had risen to almost 85 percent.

(*b*) *Changes in imports.*—Imports of watch movements rose from 9.3 million in 1954 to approximately 12.8 million in 1963. It is significant that total imports reached virtually their present level in 1956, in the first burst of pin-lever activity, and have risen very little since. In 1963, total imports declined somewhat.

Imports of 17-jewel watches have remained fairly steady over the decade, standing at 6.2 million units in 1954 and 6.3 million units in 1963.[1]

The bulk of the increase in imports of watch movements in the decade has been in the 0- and 1-jewel category, where the increase was especially sharp between 1954 and 1956, when the initial pin-lever influx began. The curve which began at approximately 2 million movements in 1954 rose to a peak of 6.4 million in 1959 and has since turned sharply downward reaching a low of 5 million movements in 1963. It is interesting that the decline in pin-lever imports since 1959 has corresponded with the increase in duty-free shipments from the Virgin Islands. It is also significant that while pin-lever imports were dropping by about 20 percent, domestic production of pin-lever movements was increasing.

Thus, the overall increase during the decade in imports of watch movements has been substantially caused by increased imports of pin-lever movements, and

[1] The 1963 figure may be slightly high, since the Commission's statistics for 1963 lump together 8–15- and 16–17-jewel imported movements.

the decline in total imports in 1963 also reflects the recent drop in imports of pin-lever products.

Fluctuations in imports of jeweled-lever movements have tended to parallel rises and declines in domestic production. This phenomenon suggests that demand for domestically produced and imported watches is most sensitive to changes in aggregate demand or disposable income.

Perhaps the most interesting aspect of the development in imports over this period, however, has been the rapid growth in the number of imported movements that are brought in by the domestic watch-producing companies. Since 1956, imports by importer-assemblers have remained virtually constant, whereas there was an increase of about 1 million in importation by domestic manufacturers. Accordingly, the entire increase in imports over this span of 8 years is attributable to importation by domestic manufacturers from their oversea establishments or other sources.

In percentage terms, imports by domestic producers have increased by about 50 percent since 1956, while during the same period, sales of their U.S.-produced watches have increased more than 25 percent. Imports by the more than 200 importer-assembler firms have failed to grow at all during this period. In this connection, it is interesting that Bulova, Elgin, and Hamilton, who like to blame all their problems on the Swiss, apparently import a great many more watches themselves from Switzerland and Japan than they produce domestically—although, of course, they neglect to mention this fact when describing the alleged domination of the U.S. market by foreigners.

(*c*) *Total market position of domestic producers.*—As a result of both increased domestic production and increased imports, the domestic manufacturing industry has enlarged its share of the total watch market in the United States to a point where it stands at about 59 percent today. Watches containing domestically produced movements account for approximately 46 percent of the total domestic watch market. It is abundantly clear that both production and sales by domestic companies have substantially improved over the past 10 years, both absolutely and relative to the position of the importer-assemblers.

In summary, the U.S. watch market has been characterized by (*a*) increasing consumption, in which domestic production has fully shared; (*b*) a notable expansion in pin-lever production in the United States; (*c*) a concentration of jeweled-lever production in high-jewel and battery-powered watches; (*d*) a substantial increase in imports by domestic manufacturing companies; (*e*) stagnation and decline in imports of jeweled-lever watches by importer-assemblers; and (*f*) a substantial increase in imports of pin-lever watches over the decade, with a dramatic decline in the last several years probably caused primarily by shipments from the Virgin Islands.

(2) *Increases in labor productivity*

One of the striking developments over this period has been the increase in productivity of labor engaged in the manufacture of watches in domestic establishments. Changes in productivity are one of the best indexes and tests of adjustment to a competitive situation. An increase in labor productivity implies a reduction in unit labor costs. Data on employment and production suggest a significant trend of improvement by the domestic watch manufacturing companies over the period under consideration.

Over the 10-year period, the number of workers employed in producing watches and movements in the domestic manufacturers' establishments rose and then declined, standing in 1963 at about 4-percent less than in 1954. Man-hours devoted to watch production also declined, from 13.3 million in 1954 to 12.4 million in 1963. There were, of course, intervening fluctuations in employment and hours worked, but for the decade as a whole, the trend has been slightly downward, both in terms of man-hours and number of workers.

There has, however, been a very significant upward trend in employee productivity in watchmaking. Both output per worker and output per man-hour have increased since 1954. The increase in productivity has been particularly marked in the domestic establishments manufacturing jeweled-lever watches where the increase has been somewhere between 50 and 100 percent over this period.

We realize that indexes of increased productivity for the industry were undoubtedly influenced to some degree by two developments over the decade; namely, the trend toward increased pin-lever production as a share of total U.S. output, and the increased utilization by some manufacturers of imported components. We have no precise way of adjusting our productivity figures to compensate for these factors; but the Commission can readily ascertain that the upward trend in productivity is genuine and has been dramatic over the past 10 years for jeweled-lever watch manufacturers.

The increased productivity is no doubt attributable in large measure to improvements in production techniques and the use of newer and better machinery. It has consequently rendered some of the machinery and equipment in domestic establishments obsolete—a factor which the Commission should obviously take into account in assessing the degree of underutilization of equipment, if any, in domestic establishments.

(3) *Internationalization, diversification, and innovation in the domestic industry*

Another striking development over this period has been what might be described as the "internationalization" of the domestic industry as well as its diversification. In 1950, there was scarcely any diversification in the domestic watch industry. Since that time, Hamilton, Elgin, Bulova, General Time, and United States Time have extended their operations domestically into a wide variety of defense and nondefense activities, many of which utilize equipment and skills identical to those found in watch production. In 1963, the domestic manufacturers sold over $90 million worth of nonwatch items produced in their watchmaking establishments, accounting for nearly 40 percent of the sales of these establishments. In addition, these companies produced very substantial volumes of defense and civilian items at other, nonwatch, plants. We believe that the Commission will want to consider these nonwatch facilities owned by the domestic manufacturers, as well as their watchmaking establishments, in rendering a judgment on the probable economic effect of duty reduction.

In addition to diversifying into other fields, the domestic manufacturers have greatly expanded their international watch operations. Their internationalization, which has become an increasingly important factor during the past decade, is reflected in growing utilization of imported parts, growing importation of complete movements, and increased sales in world markets. While we possess no statistics concerning the importation of components by the domestic manufacturers, or their sales in world markets, we believe these matters should also be considered by the Commission in determining whether a termination of the escape clause would, in fact, have an injurious effect.

These developments have had an important effect in assuring greater choice, greater freedom of action, and more security for the domestic manufacturing firms.

One of the most striking developments has been in the area of product innovation, most notably the introduction by domestic movement producers of battery-powered watches. The electric watch was first introduced by Hamilton in the beginning of 1957, then followed by Elgin, Bulova, and United States Time. Demand for these watches has been excellent, and Bulova was able to report in its 1963 annual report that demand was "extraordinary" and that in the fiscal fourth quarter "orders for Accutron timepieces increased to four times the scheduled production rate for the calendar year, necessitating a sharp acceleration in output. The backlog of orders for Accutron remains significantly higher than in previous years * * *."

(4) *Virgin Islands and smuggling*

I know that the Commission is familiar with acceleration of smuggling and the introduction of shipments from the Virgin Islands during this period. These two developments mean that a huge number of watches are being consumed in the United States which have not been produced in this country and on which no duty has been paid. I think it is clear that if these two situations could be substantially moderated—as they would be, we believe, through tariff reduction—the domestic production picture would be even better than it is.

Shipments from the Virgin Islands, which ammounted to about 1.1 million units in 1963, consist almost exclusively of jeweled-lever watches. Smuggled movements are entering, we estimate, at a rate of 1 to 1.5 million units a year, and it is generally agreed that these are largely jeweled-lever watches as well. If these two situations were alleviated, one could reasonably expect that domestic production would be a substantial beneficiary. By domestic production I refer not only to jeweled-lever watch production, but to pin-lever production as well since the latter is directly affected by the competition resulting from the introduction of lower unit price watches in the American market from these two sources.

A reduction of smuggling and shipments from the Virgin Islands will leave a shortfall in the supply of watches available to satisfy consumer demand for watches in the United States. A significant portion of the increased supply to fill this gap will inevitably come, we believe, from domestic sources.

You have before you a collection of tables and charts covering pertinent data with regard to the watch industry (attached).

May I say that we are limited in the documentation and thoroughness in our analysis by the lack of availability of certain data. The Commission well understands what these limitations are, many of which relate to the confidentiality restriction under which the Commission operates. We have, nonetheless, in the tables before you, attempted to provide as complete data as we can. A methodological note appended to the tables explains the procedures which we used in this respect.

III

THE PROBABLE ECONOMIC EFFECTS OF TARIFF REDUCTION

On the basis of the considerations which we have developed, we can now proceed to an analysis of the probable economic effects of a restoration of the concession rates. What we will be concerned with are the probable effects on the "domestic" industry as it is constituted today and in terms of economic factors which appear to be relevant today and for the near term.

I need hardly point out that it is impossible to predict these effects with any precision. The Commission knows this, of course, from its just completed investigations under section 221. It is worth noting, in this connection, that whereas the section 221 investigations were related to the effects of a possible 50-percent reduction in duties, this investigation is concerned with the effects of, at most, a one-third reduction in duties.

Any analysis of the effects of tariff reduction must start with the effect of tariff reduction on prices. For the impact of a duty cut on competing domestic production depends primarily on the extent to which prices of imported products may, as a result, be reduced and the extent to which imports may consequently increase.

In our opinion, there is no doubt that a decrease in duties will find some reflection in terms of lower prices to consumers, particularly for watches containing less expensive imported jeweled-lever movements. For reasons which will be discussed later, however, it is not likely that the full amount of the duty reduction will be reflected in lower prices of watches containing imported movements. Furthermore, the extent of such price adjustment will vary with the type of watch.

Merely for the purposes of analysis—and not because it bears any necessary relation to reality—let us assume that a decrease in duties will find no reflection in terms of lower prices for watches containing imported movements. If this were true, then we could stop our analysis at this point. If there is no adjustment in prices, the reduction of duties—which are paid by importers upon importation—would be reflected in an increase in the profits of importers. By importers I, of course, mean all importers, which covers all firms in the industry.

It is unrealistic to assume that no price reduction would result from duty reduction. Nevertheless, there are several important factors working to moderate the extent to which duty reduction would be reflected in a reduction of prices:

(*a*) All elements in the industry—importers and domestic manufacturers alike—have a keen desire to improve their profit positions. All firms within the industry which publish financial information—with the exception of U.S. Time—are experiencing relatively low levels of profitability. The profit position of the jeweled-lever importers and domestic producers, in particular, has deteriorated badly during the past decade, with the position of the major importer-assembler firms showing a greater deterioration than that of the companies which have domestic watch movement production facilities. Accordingly, there is a strong incentive operating on all importers (including the domestic manufacturers who themselves engage in import operations) to absorb some part of the tariff reduction so as to improve their operating margins and their net profits.

(*b*) There is upward pressure on prices in Switzerland due to the inflation in that country which has been induced, in part, by a shortage of labor and which has necessitated importation of perhaps as much as 10 percent of the labor force in the Swiss watch industry. The average industrial wage in Switzerland rose 4.2 percent in the first half of 1963. Similarly, the cost of living in Switzerland has recently gone up by about 4 percent annually, while the purchasing power of the Swiss franc has decreased by about 12 percent since 1960. Prices of watch movements and parts already increased in Switzerland in recent years, and there is reason to believe that inflation may cause a further rise in the cost of watch movements. These increases would occur, of course, regardless of the level of American duties; but it would be reasonable to anticipate that such increases would, in some part, offset a reduction in the duty, reducing the extent to which the duty reduction could be reflected in price reduction for watches with imported movements sold in the U.S. market.

(*c*) The nature of the demand function for watches also acts as a restraint on price cutting. In common with other consumer durable goods, the demand for watches tends to be inelastic with respect to price and relatively elastic with respect to changes in disposable income. The major factor, therefore, influencing the consumption of watches over a period of time has been and will continue to be the factor of income. From the point of view, therefore, of aggregate demand for watches, the price inelasticity which characterizes that demand function will act as a restraint on price cutting.

For these reasons, we believe that, while prices of watches with imported movements will drop following a tariff rollback, the decrease—as a percentage of wholesale price—will be significantly less than the percentage reduction in duties.

But we must carry the analysis further. We are interested in arriving at some judgment as to the extent to which a reduction in the price of watches containing imported movements will affect the demand for watches containing domestically produced movements. What is involved is an analysis of the cross-elasticity of demand between these two types of products. A precise quantitative analysis of this subject is impossible; the best that one can do is to adduce what might be described as circumstantial evidence.

Our analysis leads us to the conclusion that there will not be an appreciable impact from a duty rollback with regard to medium- and high-priced merchandise—that is, in the market where the domestic movements produced by Bulova, Elgin, and Hamilton compete. We come to this conclusion for a number of reasons:

(*a*) First of all, the amount of the tariff reduction will be relatively small compared to the price of a watch of this quality. To the extent that the duty cut is passed along to consumers, the percentage reduction would be so small as to make scarcely any impact on the medium- and high-priced market.

(*b*) Furthermore, cross-elasticities of demand tend to be reduced the more the products involved can be differentiated. That is to say, the more consumer preference is developed for a particular product, the less likely the consumer is to respond to changes in the price of competing products. There is, of course, considerable product differentiation both in respect of imported and domestically produced watches in the middle and higher price ranges, where there has been a development of considerable brand loyalty through advertising, etc., over a span of a great many years.

(*c*) The domestic jeweled-lever manufacturers have concentrated their domestic production in the over-17-jewel category, where they receive a prohibitive rate of protection, and in new types of watches which are, to a large degree, invulnerable to price competition by importers. Bulova's Accutron, for example, is a high-priced watch which has been heavily advertised because of its unique features; and to much the same extent, Hamilton's battery-powered watches are also not exposed to import competition through modest price adjustments such as might follow a tariff cut.

To the extent that added competition will occur as a result of duty reduction, we believe this will be largely restricted to the low-price end of the market, where cuts in the prices of inexpensive jeweled-lever imports will give added competition to pin-lever products, both imported and domestic, as well as to jeweled-lever watches produced by U.S. Time.

Despite the apparent higher cross-elasticities in the submarket for inexpensive watches, it is our conviction that a reduction in the duty would not have a significant effect on the profitability, employment, or use of facilities by the domestic manufacturers. Domestic producers heavily dominate the market for less expensive timepieces. Their sales of pin-lever products, and inexpensive jeweled-lever products, have grown dramatically and steadily. They have excellent distribution systems, their products are well accepted in the market, they are soundly financed and managed—in brief, they are well equipped to meet the competition in the market and they have little to fear from a drop in duty protection.

The production of pin-lever watches has doubled over the decade, employment has increased by almost the same percentage and profitability has remained high.

The impact of increased import competition, at worst, is likely to cause some reduction in the rate of growth rather than actual reduction in production or employment. Thus no consequential effects for resources can be envisaged.

As an indication of the degree of competitive strength enjoyed by this sector of the watch industry, it should be noted that imports of pin-lever watches have shown a steady decline since 1959 such that 1,400,000 fewer units were being imported into the United States in 1963 than in 1959. This decline in imports occurred despite the fact that the unit value of imported pin-lever movements was declining.

In addition, two other factors will definitely tend to mitigate the impact of a duty cut. First, pin-lever and lower priced jeweled-lever manufacturers in the United States tend to use a significant proportion of imported components in their watch production. A reduction of duties on these items under the Kennedy Round (which is favored by U.S. Time) would improve the competitive position of the domestic manufacturers.

Second, and much more important, we anticipate a sharp curtailment, as a result of duty rollback, in the number of movements which are smuggled into the United States and shipped duty free from the Virgin Islands. As has been indicated, such imports are entering the U.S. market in great quantity and are having a severely depressive effect on the market, particularly with regard to pin-lever and lower quality jeweled-lever movements Of course, other domestic manufacturers as well as importers who pay the duty will also benefit from the curtailment of such imports and shipments.

CONCLUSION

Trying to determine probable economic effects of tariff reduction, as the Commission well knows from its section 221 exercise, is not an easy or certain exercise. There is, however, as the law contemplates that there should be, some basis for making a reasonable judgment. This is particularly so, as I suggested at the beginning of my statement, in section 351(d)(2) proceeding as distinct from a section 221 investigation. Under the section 351(d)(2) procedure, although the advice to be rendered by the Tariff Commission involves prediction, it is nonetheless also partially retrospective. For what is under consideration is the effect of restoring concession rates which have been increased for a temporary period for the purpose of affording the domestic industry an opportunity to adjust. We have noted that the domestic producers have made a remarkably successful adjustment over the 10-year period since the tariffs were increased.

Based on our analysis of the consequences of tariff reduction on the industry as it is constituted today and under the criteria of law which are now applicable, we have concluded that the probable economic effect on the domestic watch industry would be minimum and would be easily met by adjustments which the industry is equipped to make. It is, after all, the public policy of the United States under the Trade Expansion Act of 1962 to make tariff reductions and it is intended that such tariff reductions have some effect. The question is one of distinguishing between effects which are tolerable and those which would place an onerous burden of adjustment on the domestic industry. We believe that the effects of restoration of concession rates would be minimal and well within the limits of toleration contemplated under the statute.

In terms of the specific economic effects of the duty reduction, we believe the degree of increased price competition resulting from a duty reduction will be moderated: (1) By the pressure on all elements in the industry, with the possible exception of United States Time, to increase profit margins; (2) by the likelihood of a rise in the price of movements imported from Switzerland; (3) by the overall price inelasticity of demand; and (4) by the alleviation of price pressures resulting from smuggling and duty-free shipments from the Virgin Islands. In turn, the growth of the market, supported by anticipated increases in the GNP and in disposable income to which the demand function for watches is closely related, should provide more than adequate opportunities for all elements in the industry to achieve an absolute increase in sales. Any adjustment on the part of the domestic industry will thus take place against a background of overall rising demand.

Accordingly, we do not foresee any net reduction in the demand for domestically produced watches. With regard to the jeweled-lever segment of the industry, the position of Bulova, Elgin, and Hamilton is strongest in the medium and higher price brackets, especially in the over-17-jewel and battery-powered categories where they have concentrated their production. Although there may be some retardation in the rate of growth of domestic production of pin-lever and inexpensive jeweled-lever products, it is reasonably clear that this is the area of greatest comparative advantage for domestic watch production, and the long-term growth of this segment of the industry seems assured. It is in this segment of the market, moreover, where the greatest advantages to domestic production are likely to accrue as a result of the curtailment of smuggling and shipments from the Virgin Islands.

For these reasons, we do not foresee any significant adverse effects on employment by the domestic producers or on their use of productive facilities. As for the question of profitability, the domestic manufacturers themselves testified in March that tariff reduction would enhance their profitability. This, in turn, would permit larger expenditures on research, development, advertising, and promotion, as well as additional capital investments which would improve the aggregate position of the industry as well as that of the individual firms.

Our analysis, therefore, leads us to conclude that the probable economic effects of the restoration of concession rates would involve improvement in several respects and moderate and easily effectuated adjustments in other respects. These probable economic effects are, in our judgment, of a character which readily permit restoration of the concession rates.

Charts and Statistics Submitted on Behalf of American Watch Association, Inc., to the U.S. Tariff Commission (May 12, 1964)

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SHARE OF U.S. WATCH MARKET

1953 and 1963

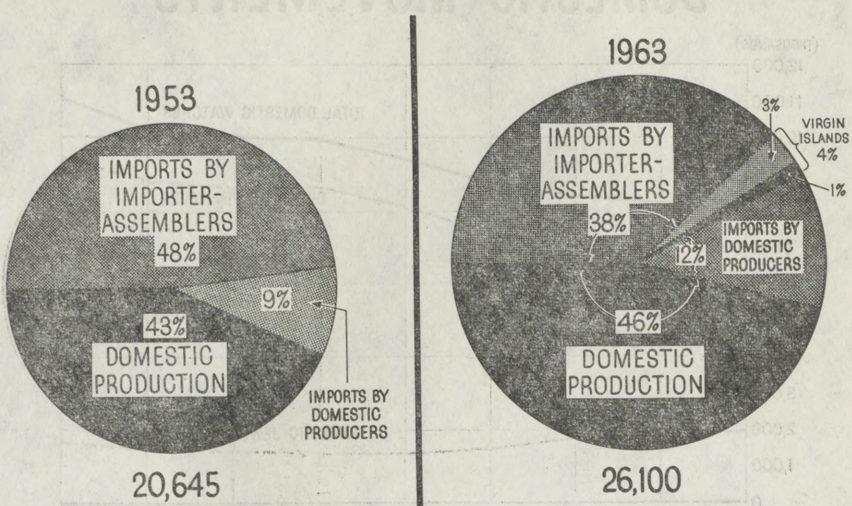

CHART II

U.S. WATCH CONSUMPTION

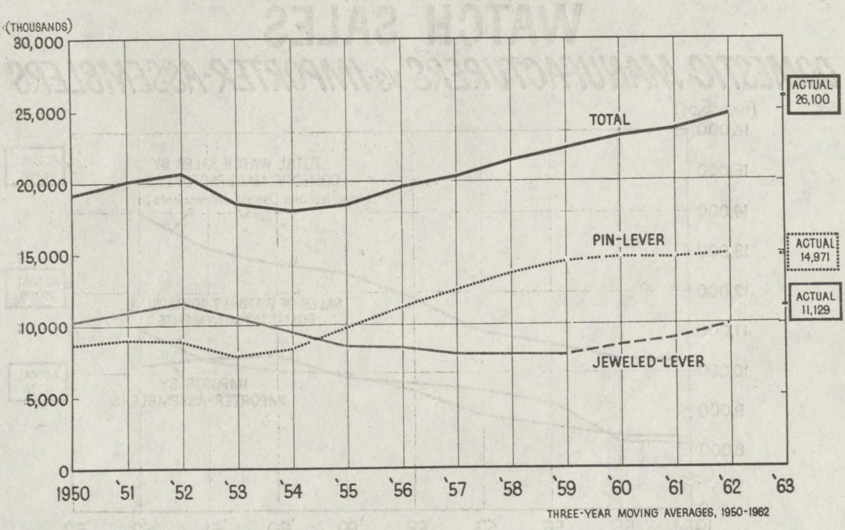

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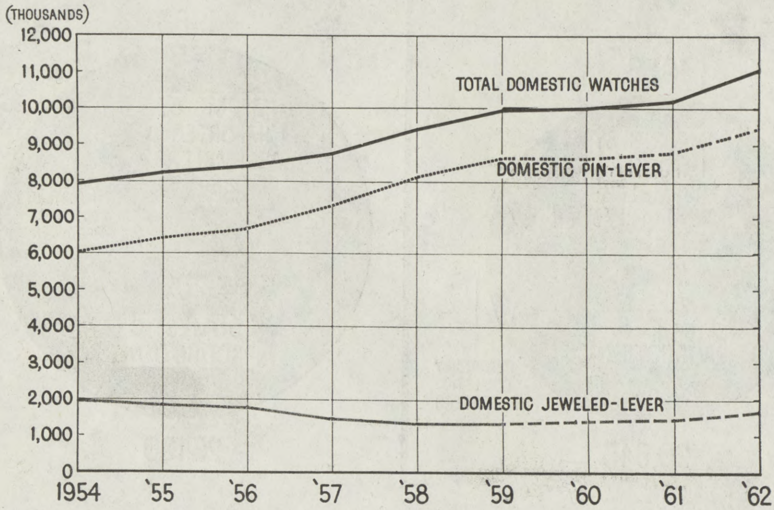
CHART III

U.S. CONSUMPTION OF WATCHES WITH DOMESTIC MOVEMENTS

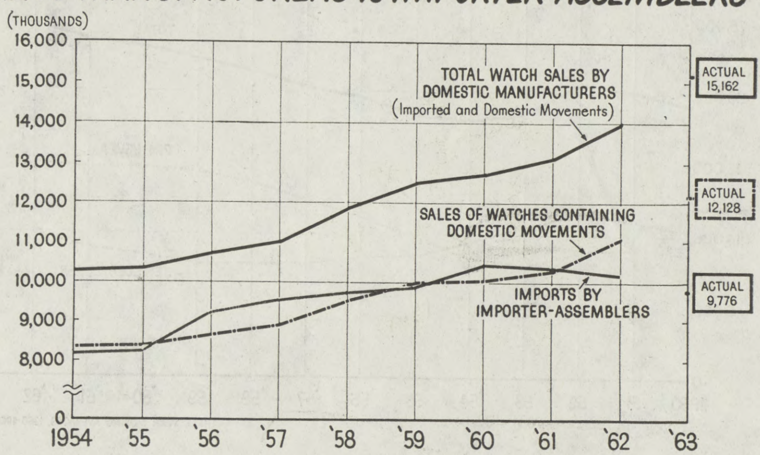


THREE-YEAR MOVING AVERAGES, 1954-1962

CHART IV

WATCH SALES

DOMESTIC MANUFACTURERS vs IMPORTER-ASSEMBLERS

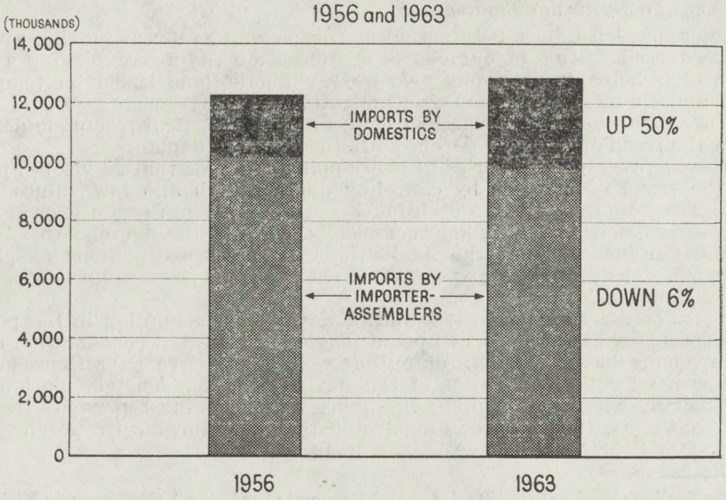


THREE-YEAR MOVING AVERAGES, 1954-1962
EXCLUDING VIRGIN ISLANDS SHIPMENTS

CHART V

WATCH IMPORTS BY DOMESTIC MANUFACTURERS AND IMPORTER-ASSEMBLERS

1956 and 1963



NOTE ON STATISTICS

1. Domestic production of pin- and jeweled-lever watches

The Tariff Commission has not published separate data on consumption or production of domestically produced pin- and jeweled-lever watches after 1959. We have made estimates of these data which were derived as follows:

Production of jeweled-lever watches and movements by domestic establishments in 1960 was estimated to be 1.65 million units on the basis of the following quote from the 1962 Tariff Commission Report on Watch Movements (p. 12): "The production of jeweled-lever watch movements amounted to 1.6 million units in 1959 * * * production was slightly higher in 1960 than in 1959 * * *." From this horseback estimate of 1.65 million units we deducted 100,000 units as our estimate of inventory accumulation and reexport of these movements, leaving 1.55 million for apparent consumption. The 1960 domestic pin-lever consumption of 7.925 million units was then derived by subtracting the jeweled-lever consumption from the total apparent consumption of domestic movements in 1960 of 9.475 million units.

The 1961 consumption of domestically produced jeweled-lever watches and movements was estimated as follows:

(*a*) The 1962 Tariff Commission Report states on page 12: "Production [of jeweled-lever watches] was slightly higher in 1960 than in 1959, but substantially lower in 1961 than in 1960. Production in 1961 was at its lowest peacetime level since 1938 except for 1 year, 1958 * * *. Production [of pin-lever watches] was substantially lower in 1960 than in 1959 and somewhat higher in 1961 than in 1960." Thus our 1961 estimate must be such that the jeweled-level production figure is less than 1.65 million units but not so much less that the remainder for pin-lever production is greatly increased over the 1960 level.

(*b*) The 1963 Tariff Commission Report states on page 9: "Production of jeweled-lever movements in 1959 (1.6 million units) accounted for 14 percent of total production; the corresponding share was slightly greater in 1960 but was slightly smaller in both 1961 and 1962." Thus another constraint on our figure for 1961 jeweled-lever production is that it must be slightly less than 14 percent of total U.S. production of watches and movements. Our horseback computation that meets all of these constraints is 1.2 million jeweled-lever movements produced in 1961, from which we again subtract 100,000 units as representing inventory accumulation and reexports. Pin-lever consumption is the result of subtraction from the given total of 9.668 million units.

Consumption in 1962 was similarly estimated from statements on the same pages in both the 1962 and 1963 Tariff Commission Reports. Our resulting figures are an estimated 1.65 million jeweled-lever watches and movements consumed and 10.269 million pin-lever watches and movements consumed. These represent 13.8 and 86.2 percent, respectively, of total apparent consumption of watches containing domestic movements.

2. The use of a 3-year moving average

In the appended tables, both actual figures as well as 3-year moving averages have been used. Some of our charts are based on the 3-year moving average data, which helps to iron out year-to-year fluctuations based on temporary factors and, therefore, gives a clearer indication of basic trends.

The use of a moving average is a conventional statistical technique designed to show the trend of a series. As one statistics textbook explains: [1]

"A moving average is a series of overlapping averages that serves to approximate the trend of a series by canceling out the high and low values * * *. If the series contains uniform cycles of 3 years' duration, therefore, each 3-year moving average will contain one complete cycle and the average will be free of cyclical influence, since the fluctuations in the two directions offset each other * * *. The period of years selected should equal the median length of the cycles in the data."

The plot of domestic, imported, and total watch consumption in the postwar period reveals that the cyclical fluctuations of total watch consumption and of its components have a median amplitude of 3 years. We have thus chosen a 3-year period for the calculation of the moving average. The calculation for a 3-year moving average is simple: the figure for each year represents the average of that year, the one preceding it and the one following it. For example, the figure for 1960 is the average of 1959, 1960, and 1961.

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[1] Spurr, Kellogg, and Smith, "Business and Economic Statistics" (Homewood: Richard D. Irwin, Inc., 1954), pp. 330–334.

TABLE 1.—*Apparent consumption of watches in the United States, by origin and type, 1926–30 average; 1931–63, annually*

[Unit: thousands]

Year	Watches with domestic movements					Watches with imported movements			Total,[1] all watches (col. (5)+(8))
	Jeweled lever	Pin lever			Total (col. (1)+(4))	2 or more jewels	0 to 1 jewel	Total (col. (6)+(7))	
		Pocket	Wrist	Total (col. (2)+(3))					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Average, 1926–30	1, 787	7, 029	1, 020	8, 049	9, 836	2, 780	1, 157	3, 937	13, 773
1931	969	3, 940	1, 587	5, 527	6, 496	815	35	850	7, 346
1932	532	2, 845	1, 778	4, 623	5, 155	422	11	433	5, 588
1933	645	3, 305	1, 900	5, 205	5, 850	431	14	445	6, 295
1934	955	4, 834	2, 532	7, 366	8, 321	841	79	920	9, 241
1935	1, 262	4, 990	2, 926	7, 916	9, 178	1, 137	64	1, 201	10, 379
1936	1, 818	7, 089	3, 373	10, 462	12, 280	2, 134	88	2, 222	14, 502
1937	2, 118	7, 393	2, 531	9, 924	12, 042	2, 957	167	3, 124	15, 166
1938	1, 372	5, 280	1, 726	7, 006	8, 378	2, 135	252	2, 387	10, 765
1939	1, 794	6, 533	2, 336	8, 869	10, 663	2, 700	219	2, 919	13, 582
1940	2, 197	6, 901	2, 869	9, 770	11, 967	3, 266	270	3, 536	15, 503
1941	2, 611	7, 480	3, 748	11, 228	13, 839	4, 045	256	4, 301	18, 140
1942	1, 773	4, 186	2, 200	6, 386	8, 159	5, 108	185	5, 293	13, 452
1943	1, 459	50	76	126	1, 585	7, 610	387	7, 997	9, 582
1944	1, 375	18	118	136	1, 511	6, 757	158	6, 915	8, 426
1945	1, 091	525	137	662	1, 753	8, 710	691	9, 401	11, 154
1946	1, 678	2, 723	1, 977	4, 700	6, 378	8, 347	418	8, 765	15, 143
1947	2, 280	4, 541	4, 283	8, 824	11, 104	6, 873	300	7, 173	18, 277
1948	2, 918	6, 523	4, 495	11, 018	13, 936	7, 332	1, 115	8, 447	22, 383
1949	2, 620	4, 018	2, 172	6, 190	8, 810	6, 367	1, 160	7, 527	16, 337
1950	2, 398	4, 504	2, 757	7, 261	9, 659	7, 594	1, 333	8, 927	18, 586
1951	3, 093	5, 099	3, 230	8, 329	11, 422	8, 759	2, 248	11, 007	22, 429
1952	2, 312	3, 320	2, 729	6, 049	8, 361	8, 607	2, 270	10, 877	19, 238
1953	2, 301	2, 744	3, 292	6, 036	8, 337	9, 613	2, 262	11, 875	20, 212
1954	1, 670	2, 611	2, 902	5, 513	7, 183	7, 045	1, 972	9, 017	16, 200
1955	1, 871	2, 852	3, 635	6, 487	8, 358	6, 062	3, 293	9, 355	17, 713
1956	1, 996	3, 592	3, 698	7, 290	9, 286	6, 904	5, 358	12, 262	21, 548

See footnotes at end of table.

TABLE 1.—*Apparent consumption of watches in the United States, by origin and type, 1926–30 average; 1931–63; annually*—Continued

[Unit: thousands]

Year	Watches with domestic movements					Watches with imported movements			Total,[1] all watches (col. (5)+(8))
	Jeweled lever	Pin lever			Total (col. (1)+(4))	2 or more jewels	0 to 1 jewel	Total (col. (6)+(7))	
		Pocket	Wrist	Total (col. (2)+(3))					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1957	1,453	1,663	4,666	6,329	7,782	6,910	5,333	12,243	20,025
1958	917	2,528	6,003	8,531	9,448	5,581	4,806	10,387	19,835
1959	1,574	(2)	(2)	9,708	11,282	7,068	6,404	13,472	24,759
1960	[3] 1,550	(2)	(2)	[3] 7,925	9,475	6,846	6,312	13,158	22,679
1961	[3] 1,100	(2)	(2)	[3] 8,568	9,668	6,928	5,699	12,627	22,468
1962	[3] 1,650	(2)	(2)	[3] 10,269	[4] 11,919	[4] 8,083	[4] 5,714	[4] 13,798	[4] 26,137
1963	(2)	(2)	(2)	(2)	[4] 12,159	[3] 7,821	[4] 4,989	[3] 12,810	[4] 26,298

[1] Beginning in 1959, "Total, all watches" includes shipments of watches and watch movements from the Virgin Islands of the United States into customs territory of the United States.

[2] Data not shown since publication would reveal the operations of individual companies.

[3] Estimated.

[4] Preliminary.

NOTE.—Apparent consumption is defined as the sum of domestic production of movements minus estimated exports of wholly domestic watches and imports of watch movements minus watches containing imported movements exported with benefit of drawback. Beginning in 1946 the quantities of movements estimated to have entered commercial channels as clocks have also been deducted from imports by the Tariff Commission; no allowance was made for such movements entered prior to 1946, the quantities involved are believed to be small.

Source: U.S. Tariff Commission:

1926–30: "Watches, Watch Movements, Watch Parts, and Watchcases," March 1953.

1931–44: (1) to (3) "Watches," war changes in industry series, Report No. 20, 1947; (6) to (8) "Summaries of Tariff Information," vol. 3, pt. 3, 1948.

1945: Computed from data from U.S. Department of Commerce, Bureau of the Census, "United States Exports of Domestic and Foreign Merchandise," 1945, and "United States Imports of Foreign Merchandise," 1945; and from U.S. Tariff Commission, "Watches, Watch Movements, Watch Parts, and Watchcases," March 1953.

1946–50: "Watches, Watch Movements, Watch Parts, and Watchcases," March 1953.

1951–62: "Watch Movements," July 1962 and 1963.

1959–62: U.S. Department of Commerce, Bureau of the Census Report No. FT-161.

1963: U.S. Tariff Commission, "Watch Movements," preliminary statistical data for use in connection with investigation No. TEA-IA-2, released Apr. 28, 1964, table 1.

TABLE 2.—*Apparent consumption of watches in the United States: 3-year moving averages, 1949–51 to 1960–62*

[Unit: Thousand]

Center year of 3-year period	Watches with domestic movements			Watches with imported movements		
	Jeweled lever (1)	Pin lever (2)	Total (col. (1)+(2)) (3)	Jeweled lever (4)	Pin lever (5)	Total (col. (4)+(5)) (6)
1950	2, 704	7, 260	9, 964	7, 573	1, 580	9, 153
1951	2, 601	7, 213	9, 814	8, 320	1, 950	10, 270
1952	2, 569	6, 805	9, 374	8, 993	2, 260	11, 253
1953	2, 094	5, 866	7, 960	8, 422	2, 168	10, 590
1954	1, 947	6, 012	7, 959	7, 573	2, 509	10, 082
1955	1, 846	6, 430	8, 276	6, 670	3, 541	10, 211
1956	1, 773	6, 702	8, 475	6, 625	4, 661	11, 286
1957	1, 455	7, 383	8, 838	6, 465	5, 166	11, 631
1958	1, 315	8, 189	9, 504	6, 520	5, 514	12, 034
1959	1, 347	8, 721	10, 068	6, 498	5, 841	12, 339
1960	1, 408	8, 734	10, 142	6, 947	6, 138	13, 085
1961	1, 433	8, 921	10, 354	7, 286	5, 909	13, 195

Source: Derived from table 1.

TABLE 3.—*Production of watches in the United States by jewel count or type of watch, 1934–55 average; 1926–63, annually*

[Unit: Thousand]

Year	Jeweled lever					Pin lever			Tota , all watches(col. (5)+(8))
	2 to 7 jewels	8 to 15 jewels	16 to 17 jewels	Over 17 jewels	Total [1] (col. (1)+(2)+(3)+(4))	Pocket	Wrist	Total [2] (col. (6)+(7))	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Average:									
1934–35	444	260	417	51	1, 172				
1936–40	223	469	765	221	1, 678				
1941–45	100	526	666	310	1, 602				
1946–50	(3)	304	1, 137	1, 034	2, 475				
1951–55	(4)	(4)	[5] 1, 225	1, 095	2, 320				
1926					[6] 2, 089	8, 270	1, 130	9, 400	11, 489
1927					[6] 2, 281	7, 732	1, 160	[7] 8, 892	11, 173
1928					1, 745	8, 010	990	9, 000	10, 745
1929					1, 737	8, 440	1, 040	[7] 9, 480	11, 217
1930					1, 330	5, 720	780	6, 500	7, 830
1931					612	4, 063	1, 587	5, 867	6, 479
1932					488	2, 887	1, 778	4, 759	5, 247
1933					463	3, 361	1, 900	5, 628	6, 091
1934					950	5, 404	2, 672	8, 308	9, 258
1935					1, 393	5, 315	3, 067	8, 675	10, 068
1936					1, 702	7, 537	3, 541	11, 370	13, 072
1937					2, 111	8, 141	2, 764	11, 173	13, 284
1938					1, 042	5, 709	1, 472	7, 374	8, 416
1939					1, 624	6, 710	2, 347	9, 259	10, 883
1940					1, 912	7, 030	2, 814	10, 279	12, 191
1941					2, 510	7, 913	3, 599	11, 956	14, 466
1942					2, 070	3, 051	1, 367	4, 476	6, 546
1943					1, 313	63	65	128	1, 441
1944					1, 014	21	82	103	1, 117
1945					1, 103	541	139	680	1, 783
1946					1, 720	2, 931	2, 000	4, 931	6, 651
1947					2, 364	4, 873	4, 321	9, 202	11, 566
1948					3, 018	6, 779	4, 523	11, 303	14, 321
1949					2, 793	4, 107	2, 182	6, 299	9, 092
1950					2, 480	4, 504	2, 761	7, 304	9, 784
1951	(8)	37	1, 839	1, 286	3, 162	5, 084	3, 242	8, 397	11, 559
1952	(8)	31	1, 523	879	2, 433	3, 295	2, 758	6, 121	8, 554
1953	(8)	39	1, 110	1, 216	2, 365	2, 709	3, 314	6, 076	8, 441
1954	(8)	(9)	846	870	1, 716	2, 596	3, 000	5, 680	7, 396
1955	(8)	(9)	701	1, 225	1, 926	2, 874	3, 680	6, 566	8, 492
1956	(8)	(9)	714	1, 352	2, 066	3, 606	3, 745	7, 383	9, 449

1957	(8)	(9)	460	1,073	1,533	[10] 1,690	4,683	6,373	7,906
1958	(8)	(9)	116	831	947	[10] 2,531	6,026	8,556	9,503
1959	(8)	(9)	263	1,351	1,614	(11)	(11)	9,720	11,334
1960	(8)	(9)	(11)	(11)	[12] 1,650	(11)	(11)	[12] 7,905	9,555
1961	(8)	(9)	(11)	(11)	[12] 1,200	(11)	(11)	[12] 8,512	9,712
1962	(8)	(9)	(11)	(11)	[12] 1,650	(11)	(11)	[12] 10,289	11,939
1963	(8)	(9)	(11)	(11)	(11)	(11)	(11)	(11)	[13] 12,159

[1] Figures for 1926–50 include small quantities of domestic movements sold uncased. In some years from 1928–36, part of the reported annual domestic production is based on sales rather than production.

[2] The small differences between totals shown and the sums of the production of pocket and wristwatches are accounted for by a small production of watch movements sold as such in some years. Beginning in 1934 the statistics exclude watch movements used in clocks. For the years 1931–33, sales as reported by the Clock Manufacturers of America have been used in lieu of production. For years subsequent to 1933 data represent production as reported to the Tariff Commission by 3 producers and sales reported in lieu of production by 1 producer.

[3] Less than 500 watches produced.

[4] Not available.

[5] Includes 8 to 15 jewel watches.

[6] As reported by American Jeweled Watch Manufacturers Association.

[7] U.S. Department of Commerce, census of manufacturers.

[8] No watches produced.

[9] If any, included with movements containing 16 to 17 jewels.

[10] Includes movements sold separately.

[11] Data not shown since publication would reveal operations of individual companies.

[12] Estimated.

[13] Preliminary.

NOTE.—The production of electric and electronic watches is included in the jeweled-lever category. No breakdown of such production is available separately.

Source: U.S. Tariff Commission, "Watch Movements," July 1956, 1957, 1960, 1962, and 1963; and preliminary statistical data for use in connection with investigation No. TEA-IA-2, released Apr. 28, 1964, table 2.

TABLE 4.—*Watches and watch movements: Sales by domestic establishments producing watch movements and relevant[1] import competition, 1951–63*

[Unit: Thousand]

Year	Imports[2] minus exports with benefit of drawback		Imported and sold by U.S. establishments producing watch movements		Relevant imports[1]		Sales of watches containing domestically produced movements		Sales of domestic plus imported watches and movements.		Total U.S. sales[3] of watches and movements by domestic establishments and importers	
	Actual	3-year moving average	Actual	3-year moving average	Actual (col. 1—col. 3)	3-year moving average	Actual	3-year moving average	Actual	3-year moving average	Actual (col. 5+col. 9)	3-year moving average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1951	11, 007	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
1952	10, 877	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------
1953	11, 875	--------	1, 925	--------	9, 950	--------	8, 769	--------	10, 695	--------	20, 645	--------
1954	9, 017	10, 082	1, 911	1, 913	7, 106	8, 169	7, 532	8, 300	9, 444	10, 213	16, 550	18, 383
1955	9, 355	10, 211	1, 903	1, 961	7, 452	8, 250	8, 600	8, 342	10, 502	10, 303	17, 954	18, 554
1956	12, 262	11, 287	2, 070	2, 073	10, 192	9, 214	8, 895	8, 613	10, 965	10, 686	21, 157	19, 899
1957	12, 243	11, 630	2, 246	2, 097	9, 997	9, 533	8, 343	8, 872	10, 590	10, 969	20, 587	20, 503
1958	10, 387	12, 034	1, 976	2, 320	8, 411	9, 714	9, 379	9, 500	11, 355	11, 820	19, 766	21, 534
1959	13, 472	12, 339	2, 738	2, 506	10, 734	9, 833	10, 776	9, 962	13, 514	12, 468	24, 248	22, 301
1960	13, 158	13, 086	2, 804	2, 667	10, 354	10, 419	9, 730	10, 017	12, 534	12, 684	22, 888	23, 103
1961	12, 627	13, 194	2, 458	2, 831	10, 169	10, 365	9, 546	10, 262	12, 004	13, 093	22, 173	23, 457
1962	13, 798	13, 078	3, 231	2, 908	10, 567	10, 171	11, 511	11, 062	14, 742	13, 969	25, 309	24, 140
1963[4]	12, 810	--------	3, 034	--------	9, 776	--------	12, 128	--------	15, 162	--------	24, 938	--------

[1] Total imports less imports sold by domestic establishments.
[2] Excluding clocks and imports from the Virgin Islands.
[3] Not comparable to apparent U.S. consumption due to differences in sources and compilation of data.
[4] Preliminary.

Source: U.S. Tariff Commission, "Watch Movements," preliminary statistical data for use in connection with investigation No. TEA–IA–2, released Apr. 28, 1964.

TABLE 5.—*Average unit value, including duty, of watch movements imported into the United States, by jewel count, 1950–62*

Year	Total	Jewel count				
		0 to 1	2 to 7	8 to 15	16 to 17	Over 17
1950	$6.54	$2.00	$4.34	$6.89	$8.16	$51.37
1951	6.36	2.06	4.14	7.28	8.35	65.48
1952	6.72	2.14	4.29	7.72	8.81	45.04
1953	6.97	2.42	4.15	7.36	9.02	49.10
1954						34.78
1955	6.81	2.66	4.17	9.46	10.11	37.01
1956	6.23	2.52	4.80	9.93	9.99	42.06
1957	6.32	2.61	4.87	13.09	9.90	38.63
1958	6.02	2.76	5.02	11.23	9.78	37.66
1959	5.85	2.87	5.08	10.59	9.24	46.67
1960	5.65	2.80	5.18	12.15	8.94	48.50
1961	5.52	2.72	5.00	10.30	8.70	46.66
1962	5.76	2.67	4.93	8.67	8.85	38.43

Source: Derived from U.S. Department of Commerce, Bureau of the Census, "U.S. Imports of Merchandise for Consumption," Rept. FT–110, 1950–61, and Rept. IQ–245, January to December 1962; and U.S. Tariff Commission, "Watch Movements," July 1963.

TABLE 6.—*Average duty per unit paid on watch movements imported into the United States, by jewel count, 1950–62 annually*

Year	Weighted average	Jewel count				
		0 to 1	2 to 7	8 to 15	16 to 17	Over 17
1950	$1.74	$0.75	$1.11	$1.87	$2.13	$10.75
1951	1.68	.75	1.09	1.83	2.14	10.75
1952	1.69	.75	1.09	1.85	2.14	10.75
1953	1.69	.75	1.07	1.85	2.11	10.75
1954						10.75
1955	2.16	.96	1.46	2.56	3.10	10.75
1956	1.99	.95	1.53	2.24	3.07	10.75
1957	2.02	.96	1.52	2.25	3.07	10.75
1958	1.93	.97	1.57	2.46	3.06	10.75
1959	1.93	.98	1.57	2.41	3.08	10.75
1960	1.92	.97	1.56	2.47	3.09	10.75
1961	1.92	.95	1.54	2.44	3.09	10.75
1962	1.97	.94	1.56	2.43	3.07	10.75

Source: Derived from table 5; and U.S. Tariff Commission, "Watch Movements," July 1956; U.S. Department of Commerce, Bureau of the Census, "U.S. Imports of Merchandise for Consumption," Rept. FT–110, 1950–61, and Rept. IQ–245, January to December 1962.

STATEMENT BY JULIAN LAZRUS, BEFORE THE U.S. TARIFF COMMISSION, JULY 29, 1964

My testimony today will deal with the claims by Bulova, Elgin, and Hamilton of injury resulting from the duty reduction on parts. I will also discuss their attempt to rule the U.S. Time Corp. out of the domestic industry and thereby to claim that U.S. Time's fabulous success story should be interpreted by the Commission as proof of injury from imports for purposes of section 301 and section 351(d)(2).

The object of this attempted gerrymander is openly acknowledged. The petition submitted by Bulova, Elgin, and Hamilton asserts on page 4 that "movements incorporating a substantial proportion of foreign parts and which could not be manufactured in the United States without such use of foreign parts cannot be denominated as 'U.S. production' in either the technical or economic sense."

The relationship of this remarkable argument to the entire economic analysis put forward by the three jeweled-lever companies is conceded on page 41 of their section 351(d)(2) brief. "Statistically," the brief notes, "if the production of U.S. Time Corp. is to be classified as domestic production, U.S. production in 1963 was 12,159,000 movements. If not, U.S. production was 3,641,000 movements."

In short, what is at stake here is the classification of 8½ million movements, and thereby hangs the validity of all the charts, graphs, and statistics which Bulova, Elgin, and Hamilton have based on the totally fallacious notion of defining these domestically manufactured movements as something other than U.S. production.

If Bulova, Elgin, and Hamilton could only succeed in getting the Tariff Commission to accept the idea that domestic employment is really foreign employment and that the Trade Expansion Act is a step toward protectionism, then the rest would be rather easy. It is nevertheless impossible to while away the Commission's own figures which show that U.S. Time has doubled the number of Americans employed in its domestic watch plants during the past 10 years or so.

Both the present case and the section 351(d)(2) proceeding must be decided on the basis of facts, not fancy. And counsel for the three petitioners as much as conceded at the hearings in May that, if his fanciful definition were not adopted, the economic analysis which the AWA had presented was substantially accurate.

It is important to understand the crucial place occupied in their whole system by the need to gerrymander the industry because it explains why so much attention has suddenly been focused by Bulova, Elgin, and Hamilton on the alleged injury caused by imports of watch parts. Bulova, Elgin, and Hamilton appear to have diagnosed the problem only quite recently.

At the March hearings before the Commission, [counsel for Elgin and Hamilton] paid scant attention to the duty on watch parts, devoting practically his entire presentation to over-17-jewel movements. In five or six sentences at various points in his statement, he argued essentially that the Commission should not render its advice to the President with regard to the watch items subject to negotiation, including parts, until it had completed its investigation under section 351(d)(2). Significantly, he made no claims regarding increased importation of parts, no allegations of past or current injury from imported parts, and no references to the "foreign" competition that the jeweled-lever producers now claim they face from United States Time's Connecticut operations.

Counsel for Bulova, during his appearance, was even more succinct, stating merely (p. 4606) that counsel for Elgin and Hamilton "has covered the parts question in his oral presentation, and for those very reasons I will not repeat them here."

The briefs submitted in March were equally shy of any evidence or, indeed, any allegation that parts importation had increased under the present duty structure or that it was injuring the industry. The theme was what might happen in the future in event of a reduction in the duties on parts.

By the time that Bulova, Elgin, and Hamilton turned in their original section 301 petition on April 15, they had quite obviously still not discovered the cause of their alleged difficulties. Although the petition asked for quotas on watch parts, the subject of parts importation was not discussed at all in 14 pages of argument and statistics. Indeed, the entire paper was devoted to jeweled-lever production and imports; mention of pin-lever developments was, with good reason, scrupulously avoided since no way had yet been found to overcome the stubborn fact of U.S. Time's prosperity.

It was some time after April 15, therefore, that the light of inspiration dawned. And it dawned with such a radiant glow that it illuminated a problem which Bulova, Elgin, and Hamilton had not previously known they faced—namely, the mortal danger posed by the increasing importation of watch parts.

* * * * * * *

The Commission's 1947 report on watches pointed out: "Some manufacturers, notably Bulova, also depend on imports for certain watch parts." And, again (p. 75): "The Elgin, Hamilton, and Waltham companies make virtually all of the parts which go into their watch movements, but * * * they import virtually all their jewel bearings and some miscellaneous parts. The Bulova Co. makes certain of its watch movements in the United States, but it incorporates in them some imported parts besides jewels * * *."

In other words, Bulova's operation was similar in those days to the United States Time operation today. Except, of course, that Bulova used a somewhat different vocabulary in describing it. When do imported parts disqualify a movement from being domestically manufactured? Apparently, when they are imported by any firm other than Bulova, Elgin, or Hamilton.

We recognize, of course, that Bulova, Elgin, and Hamilton never said it was necessary for the parts to be *manufactured* in the United States in order for a movement to be considered as domestically produced. All their counsel claimed in May is that movements incorporating foreign parts should be ruled out "in circumstances where the *capacity to produce* a substantial part of those parts does not exist in their companies, perhaps not in the United States." [Italic added.]

We gather this to mean that a company such as Elgin could import a substantial portion of its parts requirements and still qualify for treatment as a domestic producer so long as there existed somewhere in Elgin's plants a machine which could produce these imported parts.

On the other hand, United States Time, which according to testimony by one of its officers produces in the United States about two-thirds of its parts requirements by dollar volume, is to be denied the status of a domestic producer because it has sold its unused machines. In fact, were United States Time to find the threat of quotas on watch parts prejudicial to their best business interests, as well they might, the mere reestablishment of token U.S. production to meet counsel's test of "capacity to produce" would suffice to throw their domestic production figures right back into the domestic production column of Bulova, Elgin, and Hamilton's tables and charts, thus eliminating, apparently, the basis for all their claims.

As ridiculous as this rendition of the theory may seem, it is exactly what they have proposed. We have had testimony from the domestic jeweled-lever companies regarding their own imports of parts for "experimental" and other purposes. Such parts imports, however, apparently do not prevent these movements from being considered as domestic production.

An interesting aspect of the theory put forth by Bulova, Elgin, and Hamilton is that it would have ruled out the very process by which Bulova itself secured a foothold in the U.S. industry and eventually established itself as the largest U.S. manufacturer of jeweled-lever movements. It is no secret that Bulova made a successful transition from a very heavy reliance on imported parts to virtually complete domestic production facilities and that its philosophy, concerning trade barriers, changed simultaneously. Now, in league with its associates, Bulova seems to be seeking to close the door by which it entered.

If the quota on parts sought by Bulova, Elgin, and Hamilton were actually imposed, the practical result would be to forestall any new companies from entering the domestic watch movement manufacturing field. No company today would enter this field if it was obliged to start as a fully integrated manufacturer of all components. Any new competitor would certainly rely on a substantial importation of parts at the outset, just as Bulova did. Thus, as a practical matter, a quota on parts would freeze out any additional domestic manufacturing competition. And since United States Time would be unable to obtain the parts necessary for expansion of its domestic jeweled-lever output, a quota on parts would provide a permanent shelter for Bulova, Elgin, and Hamilton.

The theory of contamination by imported components, advanced by the three jeweled-lever manufacturers, is like the magic weave in the Emperor's new clothes. Its visibility, both to the wearer and the beholder, depends on a monumental self-delusion; namely, that the way Bulova, Elgin, and Hamilton choose to operate their business is the only feasible and legitimate method.

I will not repeat the more detailed arguments which were made on this point in the brief submitted by the AWA in the section 351(d)(2) proceeding. However, it must be pointed out that the theoretical insistence on complete vertical integration flies directly in the face of standard business practice in nearly every other major American industry.

Gentlemen, let us reduce this matter to the bare bones. The fact is that you are being asked to find that serious injury has been inflicted on the domestic industry by the importation of a handful of watch parts, not including jewels, whose total value in their absolute peak year amounted to less than $3 million. There is no claim of damage to the domestic watch parts industry because, as I testified in March, there is no such industry existing as an independent entity. And, indeed, a substantial proportion of all imported parts are not competitive in any sense with any domestic product since they are imported solely for the repair of imported watch movements for which no domestic parts are produced. Perhaps one-half of all imported parts are in this category.

Thus, in actual fact, about $1.5 million worth of parts are involved, and you are being asked to believe that this $1.5 million "tail wags the dog"—a quarter-of-a-billion-dollar industry. You are also being asked to believe that imports of parts for pin-lever watches—which are the imports complained of—somehow injure the three petitioners.

In essence, the argument is that United States Time is, or is on the road to becoming, a foreign competitor of the domestic industry. Thus, the brief submitted by Bulova, Elgin, and Hamilton in the section 351(d)(2) proceeding argues that United States Time's utilization of imported parts amounts to "a process of transfer to complete importation." However, this is directly contrary to statements by United States Time, which testified in May that the percentage of parts imported by the company leveled off "about 3 years ago." Furthermore it was noted that United States Time's "domestic labor force contributes 66 percent of the labor content of our watches sold in the United States of America. But it is the 34 percent of the labor content abroad which has made our operational formula successful." From this testimony, it is clear that any increase in United States Time's volume of parts imports during the last 3 years would be attributable solely to increased sales of domestic movements by United States Time or to parts used in repairs. This increased volume has been accompanied by increased utilization of domestic resources and, indeed United States Time, has "doubled our domestic labor force employed in watchmaking in the past 15 years." In short, the talk of "a process of transfer to complete importation" is a fundamental misinterpretation of what has been occurring.

Bulova, Elgin, and Hamilton are, in fact, attempting to enlist the aid of the Tariff Commission in the competitive battle which the three companies have been waging, with less than outstanding success, on the United States Time Corp. Although this design will be denied, how else should one interpret a thesis which would result in United States Time's foreign sourcing being ruled a form of foreign manufacturing? If the relief which is sought were to be granted, United States Time would presumably be compelled, in greater or lesser degree, to abandon its cost-cutting "formula."

These at least are the logical implications of the petition now before you. If they seem farfetched, it is because the basis of the petition is farfetched.

The absurdity of the parts thesis is so self-evident that it would be easy to avoid any comment, were it not for the fact that the entire case of the petitioners is based on this argument.

If United States Time is part of the domestic-manufacturing industry, then production is up and overall employment is up, and all the lines which we showed climbing on our charts in May really do climb. That is why we have treated the subject of parts so thoroughly today, even though what we have said is so obviously true as to be somewhat self-evident.

Statement by M. Fred Cartoun Before the U.S. Tariff Commission, July 29, 1964

Mr. Chairman, gentlemen, listening to the presentation by the domestic manufacturers is something like walking into the hall of mirrors at an amusement park, where all the mirrors are grossly distorted so that a big, strong, healthy man looks like a little anemic guy on his last legs. And Bulova, Elgin, and Hamilton want the Commission to look only at the distorted image of their own making and not at the reality.

They want you to look into a mirror which blacks out the 1962 Trade Expansion Act entirely; or if the 1962 act is reflected at all, this act to foster freer trade is warped into a protectionist landmark. They want you to look into a mirror which does not reflect the 8 million movements produced in this country by United States Time, thereby making the largest watch company in the world and the largest employer in the domestic watch industry somehow disappear from the United States. And yesterday, gentlemen, they asked you to look into the kind of mirror that reflects a quota system, with its inevitable decrease in competition, as somehow being a step toward lower prices and other consumer benefits.

Now, gentlemen, may I state simply that the presentations which Bulova, and Elgin, and Hamilton put forth are warped and self-serving. After all, this hearing is for the purpose of adducing facts, and the simple, undeniable facts are these:

1. Total U.S. watch sales in 1962 and 1963 were at their alltime high of about 26 million units, 60 percent above the 1954 level and more than three times as high as the average level of watch sales in the 5-year period preceding the 1936 United States-Swiss Trade Agreement.

2. The five domestic watch manufacturers dominate the U.S. market, and as we demonstrated in May, their domination is appreciably greater today than in 1954. Last year, these five firms sold 59 percent of all watches consumed in this United States. Sales of watches containing domestic movements accounted for nearly one-half (47 percent) of all watches sold in the United States in 1963. Approximately 12.2 million watch movements were manufactured in the United States last year. This was about 38 percent more than the output in 1953 and 65 percent above the output in the 5-year period before 1936.

3. In 1963, we estimate that approximately 1.9 million jeweled-lever watches were produced in the United States. This was 14 percent higher than the domestic output in 1954 and 144 percent above the average jeweled-lever production in the 1931–35 period.

4. Similarly, in 1963, we estimate that approximately 10.3 million pin-lever watch movements were produced in the United States. This was 87 percent higher than the output in 1954, and 58 percent above the 1931–35 production level.

5. We have not been able to obtain precise figures on employment at domestic watch establishments in the period prior to the 1936 concession, but available data indicates that the total number of workers was appreciably lower than in recent years. In the past decade, while total employment at these establishments has declined, Tariff Commission figures show that the decline has occurred exclusively in employment devoted to nonwatch production. Employment in watchmaking has remained approximately steady, despite appreciable increases in production. The total number of workers engaged in watchmaking at the pin-lever plants has increased appreciably over the past 10 years. While there has been a decline in watchmaking employment at jeweled-lever companies, it is obvious that since production of jeweled-lever watch movements has not decreased, the decline in watchmaking employment is entirely attributable to increased output per worker.

The decline in nonwatch employment at these plants in recent years may have resulted from shifts of certain manufacturing activities into separate facilities, from increases in productivity, from losses of military and other contracts, or from a combination of such developments. In terms of the present proceeding, however, the significant consideration is that the decline in employment at the domestic establishments can in no way be attributed to increased imports.

6. While total imports of watch movements have increased slightly over the past decade, the entire increase was caused by stepped-up imports by the domestic manufacturers themselves. The hundreds of importer-assembler firms actually imported fewer movements in 1963 than they did in 1953 and in most of the years in between.

Imports of jeweled-lever movements were actually smaller in 1963 than in the pre-1954 period, despite the fact that Hamilton and Elgin have become very major importers in the intervening years. Obviously, there has been a significant decline in the number of jeweled-lever movements imported by importer-assembler firms.

Although imports have obviously increased since the period prior to the 1936 trade agreement, domestic production of jeweled-lever and pin-lever movements has also risen sharply compared with the 1931–35 period.

* * * * * * *

Bulova, Elgin, and Hamilton attempt to give the impression in their section 301 petition that all of the major changes which have occurred in the watch industry can be traced to the 1936 tariff concessions. This is, of course, sheer nonsense.

For example, the most dramatic shift which has occurred in the watch market in the past four decades was the change from pocket watches to wrist watches. As the Commission knows, the domestic watch manufacturers once dominated the U.S. market for pocket watches, and these companies were undoubtedly disappointed when consumer preference switched to wrist watches. But under no stretch of the imagination could it be said that the United States-Swiss trade agreement was a major element in the change in consumer tastes.

Similarly, in the post-World War II period, there was a rapid upsurge in the demand for self-winding watches. By 1950, a substantial percentage of men's jeweled-lever watches contained automatic winding devices. Again, the domestic manufacturers were disadvantaged by this development, since they failed to keep abreast of watchmaking technology. With the exception of Bulova, they were unable to market a successful self-winding movement produced in this country. Indeed, during the May hearings, Mr. Arthur B. Sinkler acknowledged that the reason Hamilton began to import in the 1950's was because the company needed self-winding movements and was not equipped to manufacture them in this country. As a matter of fact, automatic watches were increasing in popularity for more than a decade before Hamilton was able to offer battery-operated watches in very limited quantities, intended to compete in the same market. Meanwhile, because it had failed to foresee the opportunity for growth in the self-winding field, and had failed to develop a domestic self-winding movement, the company found itself relying increasingly on imports. Surely, this failure to keep pace with horological technology in the important postwar period cannot be blamed on the 1936 duty concessions.

Another major change in the watch market has been the rapid growth in the popularity of pin-lever products. As the Commission knows, a large element in this shift in consumer buying habits was the development of new technology, both with regard to the design and manufacture of pin-lever movements and watch cases. The 1936 tariff concessions had nothing to do with this increased competition for Bulova, Elgin, and Hamilton; on the contrary, the increase in duties imposed in 1954 spurred the growth of pin-lever sales, as we have explained on previous occasions.

Other major changes in the watch market include the huge influx of smuggled merchandise and the spiraling growth of Virgin Islands shipments. Again, these unfortunate developments, which unquestionably have hurt the domestic manufacturers, are clearly related to the duty increases of 1954, rather than to the concessions negotiated in 1936.

* * * * * * *

What are the facts concerning the profits of the jeweled-lever watch companies? From every indication, they make far greater profits on their domestic watch production than they do on other products which they manufacture in the United States. Testifying at the May hearings, for example, Mr. Sinkler indicated that Hamilton has been earning a rate of return on capital invested in domestic watch production of at least 5 percent. (In March, at a press conference, he used a 1963 profit figure of 6 percent on domestic watch production.) By contrast, Mr. Sinkler indicated that the company had made extremely low profits since 1950 on all of its other domestic production. In fact, on many of these nonwatch items, it was clear that the company had taken serious losses.

Now, when Hamilton decided to diversify, it had a wide variety of defense and civilian fields which it could have entered. The company obviously projected that it would earn a healthy return before it decided to enter new fields. In many cases, it was able to utilize the same production facilities and the same personnel as were employed in watchmaking. Yet, as Mr. Sinkler acknowledged, the result of 14 years of diversification, which obviously consumed a great deal of management time and capital resources, was unsatisfactory on the whole.

Of course, many other American companies have been highly successful in producing defense items, electronic equipment, instruments, automobile clocks, and other products which Hamilton found unprofitable. The net impact of Mr. Sinkler's testimony is that his company finds it easier to make money manufacturing watches in this country than in producing other lines of products. Far from showing that the domestic watch manufacturers need protection from import competition, his testimony demonstrates that Hamilton is more successful in the watch manufacturing field than in other areas where the only competition is from domestic producers.

Hamilton, of course, is not the only watch company which has had difficulties when it tried to diversify into nonwatch fields. Bulova is known to have sustained heavy losses on its electric razor venture, and Elgin's recent proxy fight results, in part, from the company's loss of some $3.5 million in connection with defense contracting. It is significant, we believe, that neither side in the proxy fight appears to have blamed Elgin's difficulties on watch imports, but rather the dispute involved questions of managerial judgment. I might add that importer-assembler firms are not immune to management errors, as is seen by the extreme difficulties encountered by Gruen a few years ago.

My point is simply this: the profits figures introduced by the domestic manufacturers do not necessarily have any bearing on the question of import competition. Difficulties in domestic watch manufacturing have historically stemmed from factors such as mismanagement or inefficiency rather than import competition, as is well understood by those familiar with the Waltham or New Haven Clock situations. On the other hand, domestic watch companies with resourceful, energetic managements have traditionally been able to earn reasonable profits. This is, of course, still true today—witness the outstanding success of United States Time.

The watchmaking operations of domestic manufacturers have made substantial strides in the last decade, as is reflected in their increased productivity and their new designs. This does not mean, as has been suggested, that the importers were in error in years gone by when we criticized their inefficiency or pointed to their failure to keep abreast of horological technology; on the contrary, their rapid strides in the last few years confirm our judgment that their need for improvement was very great.

Today, despite recent advances, there remain many additional steps which the domestic manufacturers could take to increase the efficiency of their operations. Mr. Sinkler and Mr. Henshel [of Bulova] acknowledged as much when they appeared here in May. However, Bulova, Elgin, and Hamilton appear determined to continue operating under a fundamentally inefficient system, stemming from their insistence on being fully integrated and maintaining facilities for producing virtually all components used in all models of their movements.

Nearly every successful manufacturing industry in this country prides itself on the economies which can be achieved through competitive contracting.

The automobile industry, for example, has deliberately encouraged the establishment of a vigorous group of automobile parts suppliers, both in this country and abroad. They compete for contracts not only among themselves but with plants owned by the major companies. Approximately 50 percent of the components of a GM or Ford car are produced by outside vendors. The result is a steady pressure to lower costs, to generate new manufacturing concepts, and to develop new lines of products. Ford and General Motors would probably be amazed to learn, incidentally, that as a result of their vigorous and successful subcontracting they are no longer to be considered as manufacturers—at least they would no longer qualify as American manufacturers under the definition proposed by Elgin, Hamilton, and Bulova.

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APPENDIX II

MATERIAL SUBMITTED BY GEN. OMAR BRADLEY SUBSEQUENT TO HEARING

OFFICE OF
GENERAL OF THE ARMY OMAR N. BRADLEY,
Washington, August 21, 1964.

Senator STUART SYMINGTON,
Chairman, Special Subcommittee of Senate Armed Services Committee, Old Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: Pursuant to permission granted at the hearing and in response to requests of members of the subcommittee for additional information, I am submitting herewith, on behalf of the members of the American horological industry, for incorporation in the record of the subcommittee's proceedings, additional information dealing with the importance of the U.S. horological industry to national security. A considerable part of this material is addressed to arguments presented by the witness who appeared on behalf of the importers of Swiss watches.

Also enclosed is a letter and attachments from Arthur Sinkler, chairman and president of Hamilton, containing additional data, supplementary to his oral testimony before the subcommittee, with respect to the recent Swiss watch industry antitrust ruling by the Federal district court in New York.

Sincerely,

OMAR N. BRADLEY.

U.S. WATCH PRODUCTION AND CONSUMPTION, 1931 THROUGH 1963

Attached is a table (exhibit A) showing the total U.S. watch market from the year 1931 through 1963 and indicating the source of supply as between domestic production and imports. The first five columns of this table reflect movements made from parts virtually all of which were made in the United States with the exception of jewel bearings, and housings for jewel bearings. (During World War II many of the jewel bearings were of necessity made in the United States. The difficulties with which this was accomplished have been described in the testimony presented earlier.)

The sixth column entitled "Assembly from U.S. and Imported Parts" reflects the output of one company, U.S. Time Corp., which established facilities abroad for the manufacture of parts over 10 years ago and began importing an increasing number of parts for its pin-lever watch production. In 1963 the company reported that at least 50 percent of the parts of every watch movement were imported from one of its foreign plants, principally from Scotland and France. By labor content, these imports represent about 34 percent of total labor in U.S. Time movements. The company does not have the capacity to produce all of these imported parts in the United States. For example, it no longer has any of one of the basic machines used in watch manufacturing—the screw machine. An officer of the company testified before the Tariff Commission on May 12, 1964, as follows: "It would be utterly impossible for us to compete in the market we are in if we had to make our parts here." (Transcript p. 254.) In view of this present dependence upon foreign parts and the company's orientation toward substitution of foreign parts for domestic parts, this producer is not and cannot be considered a U.S. manufacturer. It simply does not have in this country the skills and equipment required for design, engineering, tooling, and production of watches and timing mechanisms, and its product, which is a composite to U.S.-made and foreign parts, has not been included in U.S. production in this table after 1954. On the other hand, U.S. Time production cannot properly be classified as wholly imported, and for that reason it is shown in a column by itself.

This classification correctly reflects the decline of domestic watch production as a result of import competition. The gradual substitution of foreign-made parts represents an erosion of U.S. production just as does an immediate shift of U.S. production of all parts to U.S. importation of completed movements.

To serve their own purposes, importers of watch movements, who oppose any efforts by the U.S. producers to retain a watch industry in this country, would classify this output of U.S. Time, even though it is dependent upon 50 percent or more foreign parts, as "domestic production." They would put it in the same category as that of the companies which can and do produce watch movements wholly in the United States. By including the U.S. Time output in "U.S. production" they seek statistically to transform an actual decline of U.S. watch production into a theoretical increase. But, looking only at the output of companies that are capable of designing, engineering, and producing all of the parts necessary for a watch movement in the United States, there has been a decline from 8,400,000 movements in 1953 to 3,600,000 in 1963. If U.S. Time's output of watches made from U.S. parts and imported parts is considered as U.S. production, the production in 1963 would be 12,100,000 movements instead of 3,600,000.

The importers urge that the U.S. Time activity is typical of a great deal of U.S. production in many fields, in that it depends upon procurement of parts from other sources, domestic and foreign, as opposed to a complete domestic operation. They urge that this is the trend in U.S. business. The fact is that the trend is in the opposite direction—toward more integrated production. But the most important fact in relation to the present problem is that any production based upon procurement of foreign parts is not a proper basis on which the military security of this country can depend. The importance of the U.S. watch and clock producers is that they have in their domestic organizations a complete battery of skills, fully equipped to produce a needed mechanism in the shortest possible time in the event of an emergency. It is unrealistic and misleading to pretend that U.S. Time is in the same posture with respect to defense capabilities as Bulova, Elgin, Hamilton, and General Time Corp. (This is particularly true because there is an overall shortage of screw machine capacity in the United States.)

We would add that it is not to the discredit of U.S. Time that it no longer has this capability. It was forced into this position by absence of proper protection from low-cost foreign imports. Elgin and Hamilton are also importers; each imports some complete movements. U.S. Time takes the intermediate position of importing one-half of its parts for each watch issued of half of its watches or watch movements. The solution in both cases was unwelcome and unsatisfactory to the domestic companies. Hamilton has already started experimenting with the importation of a few parts for some of its movements as an economy measure, and it is quite possible that if nothing further is done to safeguard the U.S. industry, Hamilton and perhaps the other jeweled-watch companies will be forced to follow this erosive process down the path already blazed by U.S. Time. It is unrealistic and misleading to pretend that the process being followed by U.S. Time is not an erosion of the capabilities and facilities of the United States for the production of watches and timing mechanisms for security purposes.

SHARE OF THE U.S. WATCH MARKET SUPPLIED BY U.S. PRODUCTION

Exhibit B attached shows the share of the total U.S. watch market supplied by U.S. production of both pin-lever and jeweled-lever watch movements. The table depicts graphically the decline in the share represented by U.S. producers from roughly 90 percent in 1931–35 period and over 50 percent as recently as 1950 to the 14 percent it has today.

The disparity between the share of the market attributed to the total U.S. industry by the importers' witness, Mr. Lazrus, (59 percent) and by the witnesses for the domestic producers (14 percent) is explained almost wholly by the inclusion of U.S. Time's production in Mr. Lazrus' calculation and its exclusion by the domestic producers. As explained above, each and every Timex watch contains parts at least 50 percent of which have been imported from one of U.S. Time's foreign plants. These watches cannot be classified as domestic products—particularly in the context of any meaningful discussion of defense production capabilities, when U.S. Time does not have either the workers or the machinery to make a complete watch movement in this country.

THE TREND OF U.S. JEWELED-LEVER WATCH PRODUCTION

In its annual report to the President on the state of the watch industry, the Tariff Commission said in 1963: "The long-term trend of U.S. annual production of jeweled-lever movements has continued downward * * *." This is clearly demonstrated by the production figures in exhibit A and by trend chart appended as exhibit C.

In addition to the fact that Waltham Watch Co. has ceased U.S. jeweled-lever watch production since 1954, it should be pointed out that another watch company, Precision Time Corp., formerly located at Strasburg, Pa., attempted to begin jeweled-watch production about 1958. This company became bankrupt, closed its doors, and gave up the effort as of the end of 1963. Total U.S. jeweled-lever production, including that of Precision Time Corp., was 1,468,000 units in 1963. This is only slightly more than half the 2,793,000 jeweled-lever watches produced in this country in 1949 and about 60 percent of the U.S. production in 1953.

U.S. Time Corp. claims to be making jeweled-lever watches in the United States. As explained above, 55 percent of the parts are imported. Moreover, all of the parts except the escapement are identical with those used in the inexpensive Timex pin-lever watch movement.

THE TREND OF U.S. PIN-LEVER WATCH PRODUCTION

The trend of U.S. production of pin-lever watches is not only downward, but has already reached the point of extinction so far as wrist watch production is concerned. In 1953 3,313,000 pin-lever wrist watches and 2,723,000 pin-lever pocket watches were produced wholly in the United States—a total of 6,036,000. At the present time wholly domestic production of pin-lever wrist watches had ceased entirely. There exists only the hybrid production of U.S. Time Corp., discussed above, which is entirely dependent upon imports of foreign parts. Two U.S. companies, General Time Corp. and the E. Ingraham Co., continue to produce pin-lever pocket watches. Their 1963 production was about 2,173,000. They maintained this level only because there was very little import competition in pin-lever pocket watches.

During this period, imports of pin-lever watch movements rose from 2,262,000 in 1953 to 5 million in 1963. Exhibits D and E attached show the increase in imports of parts, which includes repair parts for imported jeweled-lever watches. The recent tremendous growth in parts importation reflects the foreign parts used by U.S. Time Corp.

WORLD WATCH PRODUCTION, SOURCE OF U.S. WATCH IMPORTS BY COUNTRY, AND COMPARATIVE UNITED STATES AND FOREIGN WAGE RATES

During the hearing, Senator Thurmond requested that information be submitted showing world watch production, the source of U.S. imports by country, and comparative wage rates in the watch industry in the United States and other countries.

Information showing wage rates in the watch industry of foreign countries is limited at present to Switzerland and Japan. This information is as follows:

Average hourly earnings by watch workers, including fringe benefits

Country	Hourly rate	Percent of U.S. rate
United States	$3.24	
Switzerland	1.22	34.5
Japan	.38	11.7

Estimated world watch production in selected years beginning in 1926 is shown by the table attached by exhibit F. Watch production in each of other countries (Switzerland, Russia, Japan, West Germany, France, and Great Britain) has increased steadily and, in most cases, dramatically—to the point where the Swiss make over 12 times as many watches as we do, the Russians 8 times as many, the Japanese over 3 times as many, etc. In fact, out of the eight watch-producing nations, the United States now ranks seventh, only slightly ahead of the United Kingdom whose production, having quadrupled since 1948, seems likely also to surpass ours within the next few years.

U.S. imports by country of origin during the year 1962 are shown by the following table (1963 figures are not yet available):

Watch imports into United States, 1962, by country of origin

Country	Nonjeweled	Jeweled	Total
United Kingdom	24	5,298	5,322
France	29,800	335,334	365,134
West Germany	19,046	578,544	597,590
Switzerland	5,503,901	6,649,178	12,153,079
Italy	100	34	134
Japan	6,903	428,776	435,679
Austria	0	3,015	3,015
Netherlands	0	196	196
U.S.S.R.	0	450	450
Netherlands Antilles	0	30	30
Hong Kong	0	2	2
Total	5,559,774	8,000,857	13,560,631

Watch imports into the United States by country of origin as a percentage of total imports are shown on the table attached as exhibit G. It will be seen that the Swiss account for the overwhelming percentage of U.S. watch imports of both jeweled (83.1 percent) and pin-lever (99 percent) watches. For both categories combined, roughly 90 percent of our watch imports are from Switzerland—with token quantities being imported from France, West Germany, and Japan.

DUTY-FREE IMPORTS FROM THE VIRGIN ISLANDS

During the oral testimony, there was discussion concerning the fact that the U.S. jeweled watch industry is seriously threatened by the rapid increase of duty-free imports of jeweled watch movements from the Virgin Islands.

Under present law (headnote 3(a) of the Tariff Schedules of the United States, 28 F.R., pt. II, Aug. 17, 1963; formerly sec. 301 of the Tariff Act, 19 U.S.C.A. sec. 1301a), articles "the growth or product of or manufactured" in the Virgin Islands are granted duty-free entry if U.S. value is at least twice the cost of foreign parts. As interpreted by the Treasury Department (see Customs Regulations, 19 CFR 7.8(d)), this provision has permitted relatively high-duty items with foreign components to enter this country duty free after only minor labor or assembly operations in the Virgin Islands.

More than a dozen watch companies have taken advantage of this situation. Their operations consist essentially in assembling watch movements in the Virgin Islands from parts and subassemblies imported into the islands from Japan, West Germany, France, and Switzerland on which a nominal Virgin Islands duty is paid. These companies then bring the finished jeweled watch movements into the United States without paying any duty. Hamilton and Elgin both have companies in the Virgin Islands, but both are strongly opposed to continuance of the loophole. Bulova does not have a plant there but may be forced to establish one in order to meet competition unless the law is changed.

In a typical case, 17-jewel watch movements manufactured in Europe or Japan are partially assembled, and then shipped to the Virgin Islands in separate packages of parts and subassemblies—at a total cost of about $2.95 per movement. These parts and subassemblies are assembled in the islands at a labor cost of about 70 cents plus other costs of about $1, making a total cost of $4.65. The movement thus "manufactured" in the islands is offered for sale in the United States at $6—which, being more than twice the cost of the foreign materials ($2.95), means that these movements enter the United States free of duty, and at a handsome profit to the Virgin Islands operator. A similar movement imported directly into the United States would have a landed cost, including duty, of about $6.20.

Such duty-free imports are increasing rapidly. Shipments of jeweled movements from the Virgin Islands totaled some 420,000 in 1962, as compared with only 4,900 in 1959. Shipments in 1963 totaled over 1 million movements.

The present law was intended to encourage the development of local enterprises using local labor in the insular possessions, not to provide a tariff loophole. As interpreted, however, this intention is being subverted in respect to watches and other items where the amount of work done locally is relatively insignificant. This is an abuse of the statutory privilege and without any significant benefit to the Virgin Islands. Similar operations could of course take place in other insular possessions, and it is now reported that the largest Japanese watch company is planning an extensive operation on Guam.

The Treasury Department acknowledged the need to tighten this loophole in the law and has proposed a bill to accomplish this purpose (H.R. 9320, introduced by Chairman Mills of the House Ways and Means Committee). This bill would make eligibility for duty-free entry dependent upon benefit to the Virgin Islands (or other insular possessions) to be measured by a percentage of the local labor and local agricultural materials contained in the imported article. Treasury's proposal is to permit duty-free entry into the United States if the combined value of these two local factors is at least 35 percent of the value of the article's foreign materials imported into the Virgin Islands (other than those on which U.S. duty has already been paid).

While this bill might effectively stop the present duty-free entry of certain articles from the Virgin Islands, it is not strong enough to close the loophole in respect to watches. For example, taking the $2.95 movement mentioned above in paragraph 4, all the Virgin Islands operator has to do is spend at least $1.03 for labor "with respect to or in connection with" the assembly operation (35 percent of $2.95), and the duty-free privilege would apply. He could then charge any price competition might demand (even if lower than the $6 he would have to charge to qualify under present law). Although his costs would be higher than under present law, the profit margin would still be substantial, and it is unlikely that H.R. 9320 would materially limit the existing assembly operations or discourage others from starting similar operations.

Consequently, the horological industry requested a stronger bill and, in May 1964, Mr. Mills introduced a bill (H.R. 11233) which would make the benefits of the law providing for duty-free entry inapplicable to watches and clocks. This bill has been pending for some time and should be enacted in the interests of preserving the U.S. industry. Since the introduction of this bill, the Government of the Virgin Islands has recognized the problem and has authorized the Governor to impose quotas on watch assembly in the islands, but no action has been taken, pending a report of the Tariff Commission on its present watch industry investigations.

THE INJURY TO THE U.S. HOROLOGICAL INDUSTRY'S DEFENSE CAPABILITIES

The witness for the watch importers devoted a good portion of his testimony to the exposition of a simple, superficially persuasive thesis. We are clearly on record, he says, with the concession that both the jeweled and pin-lever segments of the horological industry are equally essential to national defense. Looking at both segments, then, he finds that domestic producers have 59 percent of the market and that this share is appreciably greater than it was 10 years ago. From this he concludes that there cannot be "any serious threat caused by imports to the defense capabilities of domestic horological manufacturers."

There are two major fallacies in this thesis: First, while we have said and still say that the pin-lever (or clock or nonjeweled) segment of the industry is essential—I reiterated this, in fact, in my own testimony before the subcommittee—we have never said that the pin-lever producers possess the same high degree of skills that are found within the jeweled watch industry. As Mr. Fraker, vice president of General Time and former general manager of Elgin's Government work, put it: "There is a very definite difference between the states of the art. They are about a step and a half ahead in the jeweled watch industry than the nonjeweled watch industry as I see it, today. There are certain areas where they overlap but, when the chips are down, there are some finer points where you go to the jeweled watch industry today."

Actually, a casual inspection of the type of defense work performed by General Time and Ingraham on the one hand and by Bulova, Elgin, and Hamilton on the other—as revealed in the defense work summaries submitted by each of those companies to the subcommittee—indicates that the area of overlap between the two segments is minimal indeed and consists principally of the common production of some fuzes and fuze types. The difference in capabilities between the segments is one of degree but, as the testimony of Sandia's Mr. Draper makes clear, the difference is sometimes significant. This is not to say that the pin-lever industry is not important or even as important to the national defense; rather both segments are important but the jeweled-lever industry occupies a special position within the horological industry because of the more exacting skill requirements found there. The importers' witness was himself finally compelled to admit that a jeweled watch is more precise than a nonjeweled watch. The fact is that many U.S. defense items call for jeweled-watch precision.

Second, I have already noted that the importers' witness derived his 59 percent market-share percentage by including in domestic production the production of United States Time Corp. from over 50 percent imported parts. When United States Time's "production" is discounted—as it certainly must be for defense purposes—the second prong of his argument also falls and his conclusion that there can be no threat to the defense capabilities of the U.S. horological industry is left without any basis in fact to sustain it.

THE GROWTH OF THE HOROLOGICAL INDUSTRY'S PARTICIPATION IN MILITARY PROCUREMENT

The importers' witness told the subcommittee that the jeweled-watch companies in recent years have complained to their stockholders of cutbacks in their defense business and that in recent testimony before the Tariff Commission we said that we could not look to this business for much help because of its "feast or famine" character. From this he concluded that some of the items the watch industry has produced may no longer be needed by the military or that the industry is encountering more competition for these contracts. He assumed that both of these are true and concluded that since 1958 the horological industry has become less important to national defense. As a "case in point" of the increasing competition, he cites a single 1961 procurement for the M–525 and M–527B1 point detonating fuses.

The fact is that the dollar volume of defense business performed by Elgin, General Time, Hamilton, and Ingraham in 1963 exceeded their 1958 defense volume by more than 400 percent. The defense business of each of these companies (we have been unable to obtain this data for Bulova) increased for each year during the 1958–63 period—a steady and consistent upward trend. This experience is all the more significant in the light of the fact that there were far fewer contracts of the size of those received by the companies during and immediately after Korea and this, of course, is where the major "cutbacks" occurred. The record shows an increasing number of smaller size contracts and a growing emphasis on research, development, engineering-type assignments and on prototype and limited quantity-type production runs. It clearly does not reflect any lessening need for the type of defense work the companies are qualified to perform.

The steady increase in defense work volume (together with the testimony describing numerous items for which the industry or one of its constituent companies has been sole source) is scarcely suggestive of a defense industry being driven to the wall by excessive competition from other defense contractors. Benrus may have found that many others can assemble the 14-foot Sidewinder launcher; we have not found any others who are making tiny jeweled-lever escapements and few if any others who can design, engineer, and/or produce with comparable speed and quality and at comparable cost the many other precise parts and mechanisms that are the watch industry's forte.

The "case in point" the importers' witness cited to illustrate his point actually illustrates the way in which the importers constantly misuse facts to confuse the issue. The witness said:

"An interesting case in point is the bid opened August 29, 1961, by the Ordnance Ammunition Command, Joliet, Ill., for the M–525 and M–527B1 point detonator fuses. This is an item similar to those for the production of which the domestic jeweled-lever manufacturers claimed they were essential in earlier hearings. There were 38 bidders for this contract, of whom only 6 were part of the horological industry. Of the 12 lowest bidders, only 4 were part of the horological industry, and 2 of the 4 were Benrus and Longines, who are importer-assemblers and members of the AWA."

The point detonating fuse used in this "example" is one of the simpler types. Used in mortar rounds, it sells for about $1.50 per unit. Designed and developed by Bulova in conjunction with engineers from Frankford and Picatinny Arsenals, it is a modification of the old M–52A2 fuse. It was originally produced in quantity by the old New Haven Clock & Watch Co., now defunct. Like many items of this type, once designs are developed and techniques are perfected, and if delivery requirements are not too tight, a number of other companies find themselves "qualified" to bid on subsequent procurements. The fact that other companies are now able to produce this item proves nothing. This should have been clear long ago from Captain Adams' testimony, but the importers continue to push the point because ODM bought the idea in 1958. Actually, all bids were rejected on the occasion Mr. Lazrus cites because a large number of them failed to incorporate an Elgiloy spring in their proposals, as called for in the Government specifications. Elgiloy is a special noncorrosive, highly durable mainspring alloy originally developed by Elgin in its commercial watch business. Its many military applications are described in the summary of defense work appended to Mr. Ensign's prepared statement. The specification for use of this watch industry development is another example of the constant contributions the industry has made to advancement of proficiency in the timing device field.

When the contract was readvertised in October 1961, Benrus did not submit a bid. Insofar as we have been able to ascertain, Benrus never has made this fuse.

TECHNICAL SUPREMACY OF THE U.S. WATCH INDUSTRY IN COMMERCIAL WATCH DEVELOPMENT

The deprecating references to Bulova's Accutron and the Hamilton electric watch movement by the witness for the importers calls for brief comment. For years, before various agencies of the Government, the importers asserted that the ills of the domestic watch industry were traceable to a technological lag on the part of the U.S. producers. And many audiences were regaled with importers' exhibits of cuff-link watches, earring watches, and watches that told the phase of the moon—all as illustrative of superior Swiss watchmaking technology. While several U.S. pioneering achievements were ignored in these presentations (notably the development of unbreakable mainsprings and hairsprings, perfection of watch lubricants, establishment of assemblyline techniques, and invention of certain more efficient watchmaking machinery), it was not until the appearances on the market of the Hamilton electric in 1956 and the Bulova Accutron in 1960 that these Swiss-importer claims of U.S. technological lag were stilled.

Now the claim is being revived. The subcommittee was told by the importers witness that the Accutron is really a Swiss development and owes its commercial success to a strong patent position and that the concept of the electric watch has been known for many years and, in fact that the witness and a friend owned a patent on such a watch going back to 1948. General Bradley covered the U.S. development of the Accutron in his testimony. As to both of these timepieces, suffice it to say that the Swiss have yet to perfect a battery-driven watch for commercial distribution—though they have promised one for years. Longines in its annual report for the year ended March 31, 1960, said, "This autumn, your company will introduce the first electric wristwatch to be made in Switzerland." It did introduce such a watch—and promptly withdrew it from the market when it became apparent that it would not function properly. In its annual report for the year ended January 31, 1961, the company, of which the importers witness is president, advised that "Benrus is not convinced, however, that the public is ready for the battery-powered watch—and vice versa." It introduced such a watch just this year, however, made for Benrus by the French watchmaker, Lip. The American producers are still awaiting the Swiss electric. It is being developed in typical Swiss fashion—not by individual company competitive effort, but through their industry trade association, Ebauches, S.A., and by the creation by the Swiss watch industry in 1961 of a horological electronics center.

THE 1958 REPORT OF THE OFFICE OF DEFENSE MOBILIZATION

The witness who appeared before the subcommittee on behalf of the importers association argued at length that the 1958 investigation of the domestic watch and clock industry by the Office of Defense Mobilization established conclusively that the industry is not needed for national security. Although a complete investigation of this 1958 report would disclose some very interesting facts, it would serve no useful purpose with respect to the subcommittee's study of the watch industry's importance in 1964. The 1958 report cannot have any substantial effect upon the current study because events subsequent to 1958 have proven it to be unsound. If the 1958 report has any bearing at all, it is only to emphasize the need for the present investigation.

The two principal reasons for ODM's conclusions, as stated in the summary of the letter of the Director, Gordon Gray, dated February 28, 1958, were as follows:

"New weapons and new strategic concepts have drastically reduced the requirements for the types of military items in the production of which the horological industry has participated."

and

"The base for precision production and skills in our industrial economy has expanded substantially."

The first of these conclusions was founded on the new strategic concept then prevalent, that a military emergency would consist of thermonuclear war, involving massive retaliation, that such an emergency would be short lived, probably would be fought with weapons on hand and would involve no need for sudden expansion of armaments of all kinds. The second conclusion was the basis of an assumption that the expanded base for precision production and skills could take care of any production theretofore supplied by the watch industry. These assumptions have several basic defects.

(1) The so-called new strategic concept applied by ODM in 1958 is no longer valid. The present concept is a nuclear stalemate, with efforts to contain peripheral wars and local conflicts by use of conventional arms. Artillery, manned bombers and fighters, surface ships, and other nonnuclear weapons are still vital to national defense. Quantitative requirements such as those of Korea are still possible.

(2) The watch industry, not the predicted expanded base, is still the primary source for the requirements of new timing devices, even if quantities are reduced. The ODM report ignores the need for speed and quality in procurement of such devices in fighting both the cold war and the local emergencies which arise. That this would be so was not only predictable, but it was repeatedly predicted to ODM by disinterested persons in position to know.

Consider first the hot type of emergency. ODM had before it the testimony of two former Government procurement officers responsible for procurement during the Korean conflict of a then new type of proximity fuse, development production of which was suddenly needed when the Chinese crossed the Yalu River. Capt. R. L. Adams was Assistant Chief of the Navy Bureau of Ordnance at the time, and was responsible for procurement of the fuse for all services. Commander Gichner was his subordinate. The testimony of Captain Adams and Commander Gichner which Mr. Sinkler submitted to the subcommittee gave the history of this procurement, which speaks for itself. A copy of their testimony is attached. Captain Adams summarized his testimony in the plainest and most unequivocal terms when he said, "I can say categorically, in fact, that as far as the fuses we purchased are concerned, we could not have gotten along at all without a watch industry during Korea," and again, "Without the watch industry to fall back on we would have had to have fought this war without or with only token quantities of this critical item."

Later on, other industries were finally able to produce this item satisfactorily. Captain Adams explained, however, that they did not provide the initial leadership and skill to meet the emergency. He said:

"Other companies were later brought into the program because watch industry capacity was not sufficient to meet the service requirements. It was the watch industry, however, that got our fuse program started, that worked the bugs out of the designs, that set up the production and processing procedures."

But ODM apparently ignored Captain Adams' experience and assumed that this belated entry into production demonstrated an expansion of the base for precision production and skills which would take care of any similar demands in the future. The testimony of Captain Adams predicted that this would not be so. He said:

"It is dangerous to generalize that the precision instrument industry could supply the material traditionally obtained from the horological industry because it has not proved so in practice. Even well-managed and eminently successful instrument companies have failed completely to meet the needs of the Navy in the watch industry's field."

The testimony before this subcommittee by Mr. Mosely, vice president of Day & Zimmerman, operators of the Lone Star Ordnance plant, supports Captain Adams' view and shows that the ODM 1958 assumption was erroneous. Mr. Mosely said that within the last few months sudden urgent demands arose from the Army for immediate development and production of a complicated timing device. This was needed with respect to Vietnam. The leadtimes were so short that it was impossible to find any concern in the United States that would even bid on the contract except two jeweled-watch companies. The item was obtained by a crash program within the jeweled-watch industry, just as in Korea. Thus Captain Adams' statement in 1958 that "We have come to regard the jeweled-watch industry as our best outside source for production engineering of miniature, dependable, and complex mechanisms," is supported in 1964 by a similar experience. Mr. Mosely said, also, that the same thing had happened in 1961.

It was difficult to understand in 1958, and even more difficult to understand today, why the advice of experienced procurement men like Captain Adams was completely ignored. But the important thing is that his experience and the recent similar experience of Mr. Mosely should be given attention now.

(3) The ODM conclusions also ignored the leadership of the watch industry in needed development of advanced weapons in the cold war. It apparently assumed that the so-called expanded base for precision production and skills would also take over this function. Again ODM ignored the advice of experience. Captain Adams said:

"I have talked so much of the watch industry's performance in the fuse program during the Korean emergency only to illustrate the need for the kind of job it can do during times of crisis. But no one should suppose for an instant that the changing nature of our armament has lessened this need. Quite the contrary. The capabilities of the jeweled-watch industry are of extreme significance in our present-day weapons program. It is not by accident that the watch industry is so involved in practically all of our missile programs. Perhaps now, more than at any prior time in our history, we are going through a period of continuous refinement—of testing and retesting, evaluation and re-evaluation—of new weapons and weapons types."

* * * * * * *

"In my judgment and because of the factors I have mentioned, we will come to place even greater reliance upon the watch industry for the supply of many of our most critical weapons components both in the development and refinement of new types and for the volume production of types settled upon and selected to be operational."

That Captain Adams was right and ODM wrong appears from a comparison of watch industry participation in missile production in 1957 and 1964.

ODM was advised that in 1957 the jeweled-watch industry was supplying timing mechanisms for 20 missiles out of 23 then in production. In 1964 the 3 jeweled-watch companies were performing the same function for 17 out of 19 missiles in production and General Time Corp. was involved in another, making 18 out of 19. The total picture as shown by the table of U.S. missile production submitted by Mr. Sinkler, a copy of which is attached as exhibit H, is as follows:

Stage	1957		1964	
	Quantity	Percent	Quantity	Percent
All missiles	25 of 35	71	48 of 62	77
Development	14 of 24	58	9 of 14	64
Production	20 of 23	87	18 of 19	94
Service use	9 of 10	90	34 of 40	88

Thus, while ODM wrote off dependence upon the watch industry in 1958, in new weapons and specifically in missiles, use of the industry in the missile program has intensified. As Captain Adams said, this is certainly no accident. Where is the evidence that in this critical area our national base for such production has been "expanded substantially"? The ODM letter qouted the Director of Guided Missiles as saying that, "Viewed solely from the standpoint of potential contribution to the guided missile programs, it is evident that the horological industry cannot be considered to be essential to these programs. To the extent the facilities of the horological industry are evailable to us, we shall continue to utilize them in competition with other qualified producers in nonhorological industries." It would seem that the potential contribution was underesimated or that the performance of the watch companies "in competition with other qualified producers" must have continued to be outstanding.

The ODM report states that "No missile manufacturer questioned indicated a dependence upon the horological industry either for production or research." The number questioned and the nature of the examination are unknown, but use of the horological industry in 18 of 19 missiles constitutes dependence in fact, regardless of any opinions expressed. The figures constitute an almost unanimous empirical vote by all those responsible for the Nation's missile production that the horological industry is the best source for certain timing devices.

The difficulty of ODM and the Department of Defense seems to have been that not only ignored the facts but accepted the views of the wrong people. They ignored Captain Adams and Commander Gichner. They ignored Mr. Massie of the Convair Division of General Dynamics Corp. and Dr. C. S. Draper, head of the department of aeronautical engineering and director of the instrumentation laboratory at MIT, whose testimony is attached. ODM not only ignored, but incorrectly quoted, and then disputed, the report of its own expert, Mr. D. Leigh Stevens, a consulting engineer hired by ODM to advise it on the importance of the industry, whose report is also attached. One would almost judge from reading the ODM report that no one could be found during the many months of the ODM deliberation who was of the opinion that the watch industry had any real importance. Yet, in the short time of less than a week between the institution of the subcommittee invesigation and its public hearing, six concerns were asked to testify or submit statements on the importance of the industry and all six did so. These included NASA, Sandia Corp., Day & Zimmerman, the West Bend Co., General Electric Co., and Boeing Aircraft Co.

An outsider looking at all the facts might well conclude that Mr. Stevens, who had an inside look at the process of the ODM study from his position as a Government consultant, was possibly correct when he said in his report to ODM:

"Yet, in the context of the discussions so far, one cannot but arrive at the conclusion that defense of the United States has been given lipservice only, and the discussions run far afield into productive costs, costs of living, efficiencies of manufacture, standards of living, tariffs or what have you, and that the single simple fact of the ability to make a physical unit or component needed in the overall defense syndrome has been completely obscured."

Exhibit A

Total U.S. watch market: Production, imports, consumption

[In thousands of units]

Period of year	Pin-lever domestic production	Jeweled-lever domestic production	Total domestic production	Apparent consumption of domestic production	Assembly from U.S. and imported parts [1]	Apparent consumption of imports [2]	Shipments from Virgin Islands	Total apparent consumption	Domestic production's share of market (percent)
Average:									
1931-35	6,648	781	7,429	7,252		771		8,023	90
1936-40	9,891	1,678	11,569	11,100		2,838		13,938	80
1941-45	3,469	1,602	5,071	4,888		6,739		11,627	42
1946-50	7,808	2,475	10,283	9,978		8,168		18,146	55
Annual:									
1949	6,299	2,793	9,092	8,810		7,527		16,337	54
1950	7,304	2,480	9,784	9,659		8,927		18,586	52
1951	8,397	3,162	11,559	11,422		11,007		22,429	51
1952	6,121	2,433	8,554	8,361		10,877		19,238	43
1953	6,076	2,365	8,441	8,337		11,875		20,212	41
1954	5,680	1,716	7,396	7,183		9,017		16,200	44
1955	[3] 3,849	1,926	5,775	[4] 5,641	[3] 2,717	9,355		17,713	32
1956	[3] 4,571	2,066	6,637	[4] 6,474	[3] 2,812	12,262		21,548	30
1957	[3] 2,431	1,533	3,964	[4] 3,840	[3] 3,942	12,243		20,025	19
1958	[3] 3,327	947	4,274	[4] 4,219	[3] 5,229	10,387		19,835	21
1959	[3] 3,147	[5] 1,614	4,761	[4] 4,709	[3] 6,573	13,472	5	24,759	19
1960	[3] 2,086	[5] 1,672	3,758	[4] 3,678	[3] 5,795	13,158	44	22,677	16
1961	[3] 2,554	[5] 1,342	3,896	[4] 3,852	[3] 5,816	12,627	173	22,468	17
1962	[3] 2,837	[5] 1,572	4,409	[4] 4,389	[3] 7,530	13,798	420	26,137	17
1963	[6] 2,173	[5] 1,468	3,641	[4] 3,624	[3] 8,518	[6] 12,813	1,131	26,086	14

[1] Includes conventional pin-lever movements, "pin-lever" movements containing jewels and a jeweled-lever movement of new design. In addition to the units shown in this column, there are pin- and jeweled-lever movements, which use some imported parts. The pin-lever movements are not included in this column because their quantity is not known. The jeweled-lever movements are not included, because the producers using the imported parts also produce these parts in the United States and have existing facilities to manufacture them.

[2] Excludes movements entering commercial channels in clocks or exported with benefit of drawback.

[3] Informed estimates, based on data obtained from producers.

[4] Derived by subtracting all "exports of domestic production," as reported in USTC 1963 report on watch movements and estimated by petitioners for 1963 as 17,000, from domestic production shown herein. Petitioners do not know what portion of these exports were of pin-lever movements assembled from U.S. and imported parts rather than the domestic production, but it is believed that they were few in number.

[5] Includes estimated production of Precision Time Corp.

[6] Estimated.

Sources: Averages, 1926-50, U.S. Tariff Commission report on watches, movements, and parts (1954), table 9.

Domestic production, consumption: 1949-53, USTC 1956 report on watch movements, tables 10, 11; 1954-63, USTC 1960 report, tables 6, 7; USTC 1963 report, tables 3, 4; data obtained from producers and preliminary statistical data for use in connection with investigation No. TEA-IA2, released by USTC Apr. 28, 1964; for years 1956-63, pin-lever domestic production has been obtained by subtracting jeweled-lever production and informed estimates of units consisting of U.S. and imported parts from total domestic production reported in Tariff Commission's 1963 report and "Preliminary Statistical Data," supra.

Assembly from U.S. and imported parts: Data obtained from producers.

Imports, consumption: 1926-50, USTC 1956 report on watch movements, table 4; 1951-62, USTC 1963 report, tables 3, 9, 12; 1963, "Preliminary Statistical Data," supra: 195,000 imported movements have been deducted as estimated reexports.

Virgin Islands shipments: USTC 1963 report on watch movements, table 10, and "Preliminary Statistical Data," supra.

EXHIBIT B

DOMESTIC PRODUCTION'S SHARE OF U. S. WATCH MARKET, 1931-1963

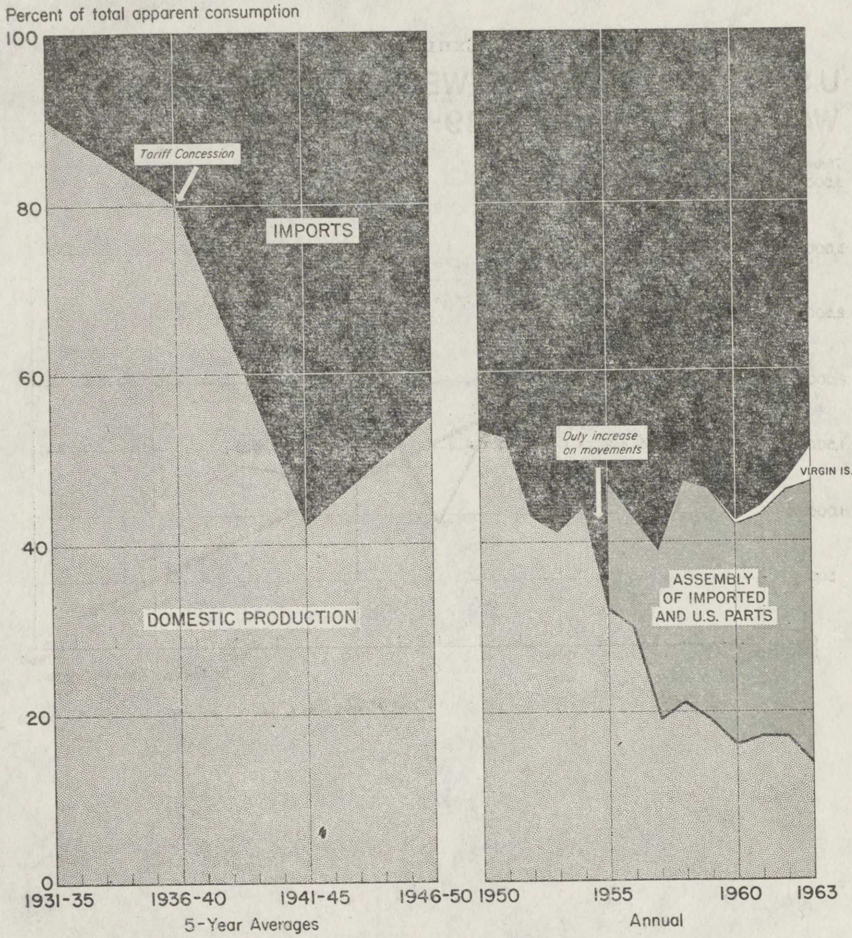
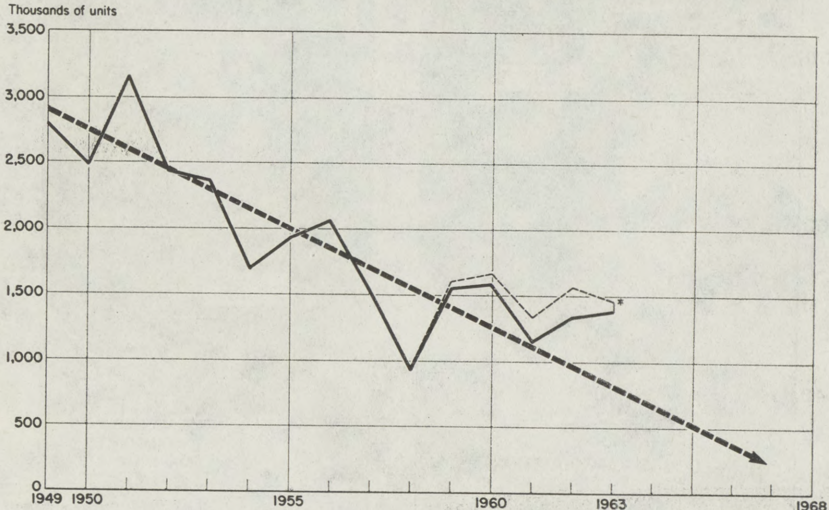


EXHIBIT C

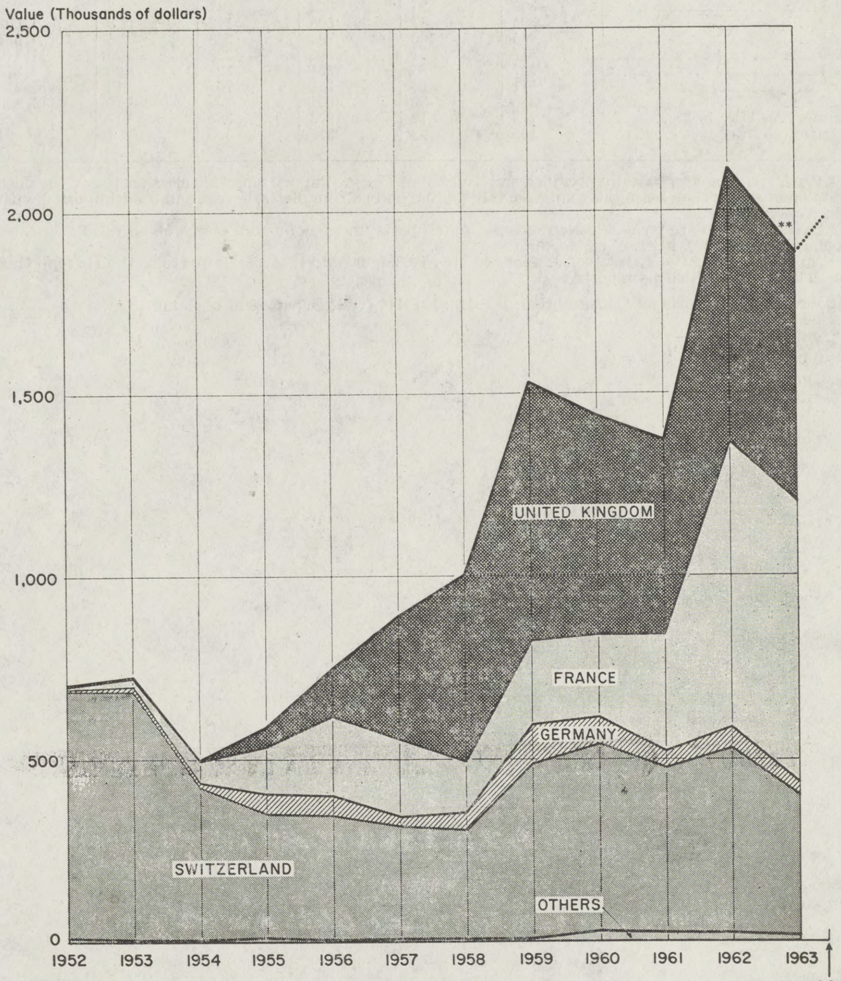
U.S. PRODUCTION OF JEWELED-LEVER WATCH MOVEMENTS, 1949-1963 (and 1968 projected)



* Includes Precision Time Corp.

EXHIBIT D

U. S. IMPORTS OF WATCH PARTS*
1952-1963



* "Watch parts, n.s.p.f." = FT 110 Bureau of Census reporting classification.

** 1963 figure incomplete due to change in reporting classification.

EXHIBIT E

Imports of unassembled watch movement parts (other than pillar plates and parts imported with complete movements) [1] *1952–63 and January–March 1964*

[Value in thousands of dollars]

Year	Switzerland	Germany	United Kingdom	France	Others	Total
1952	686	3	3	8	3	703
1953	687	13	3	22	1	726
1954	429	8	2	57	1	497
1955	346	57	52	130	4	589
1956	343	57	132	217	1	750
1957	320	27	324	217	3	892
1958	305	47	505	142	3	1,002
1959	485	106	703	233	4	1,531
1960	517	74	595	228	25	1,440
1961	457	45	531	321	20	1,375
1962	511	64	751	767	18	2,112
1963 [2]	386	39	671	768	[3] 16	[2] 1,880
January to May 1963	173	12	273	323	[3] 17	798
January to May 1964 [2]	155	23	316	396	4	[2] 894

[1] Watch parts not specifically provided for; Bureau of Census import reporting classification. Includes watch parts other than assemblies, subassemblies, pillar and bottom plates, jewels, and parts imported with complete movements.

[2] Incomplete, due to reclassification of some watch parts under nonwatch categories in tariff schedules of the United States, in effect since September 1963.

[3] Apparent inconsistency between January to May 1963 figure and 1963 total is due to method of reporting small numbers in monthly reports.

Source: U.S. Imports for Consumption, FT-110; IM-146 (U.S. Department of Commerce).

EXHIBIT F

Estimated world watch production

[Thousands of units]

ALL WATCHES

Year	United States	Assembly of United States and imported parts	Switzerland	U.S.S.R.	Japan	West Germany	China	France	United Kingdom	Total
1926	11, 489		17, 185	0	500	4, 000	0	2, 500	5	35, 679
1937	13, 284		23, 916	500	1, 530	6, 600	0	3, 500	1	49, 331
1948	14, 321		24, 357	4. 000	592	1, 000	(1)	3, 900	800	48, 970
1951	11, 559		33, 549	5, 000	924	4, 719	(1)	4, 100	1, 717	62, 568
1956	6, 637	2, 812	39, 676	9, 500	2, 663	7, 800	(1)	4, 500	2, 836	76, 424
1963	3, 641	8, 518	45, 532	27, 000	12, 076	8, 500	8. 000	7. 000	3, 490	123, 757

JEWELED-LEVER MOVEMENTS ONLY

Year	United States	Assembly of United States and imported parts	Switzerland	U.S.S.R.	Japan	West Germany	China	France	United Kingdom	Total
1963	1, 468	(2)	28, 675	27, 000	12, 076	5, 000	(1)	2, 500	500	77, 219

[1] Not available.

[2] U.S. Time Corp. assembles in the U.S. certain movements containing 55 percent imported parts and 45 percent domestic-made parts which are identical with the parts for its nonjeweled pin-lever watches except for an escapement which uses a nonconventional jeweled-lever. These are merchandized by U.S. Time as jeweled-lever watches but are not included as such in this table because they are in all respects similar to nonjeweled watches other than the incorporation of the nonconventional jeweled lever.

EXHIBIT G

U.S. watch imports as a percentage of total watch imports, by country of origin

	Swiss	West Germany	Japan	France	All others
1957:					
Pin lever	94.2	4.5	0.04	0.01	1.25
Jeweled	94.9	3.0	0	2.1	0
Total	94.6	3.7	.01	1.2	.49
1958:					
Pin lever	95.8	3.4	0	.4	.4
Jeweled	93.1	4.8	0	2.1	0
Total	94.3	4.2	0	1.4	.1
1959:					
Pin lever	93.5	6.4	0	.1	0
Jeweled	90.2	3.7	.1	6.0	0
Total	91.8	5.0	.05	3.2	0
1960:					
Pin lever	95.6	4.3	.04	.06	0
Jeweled	85.6	7.7	1	5.6	.1
Total	90.4	6.1	.5	3.0	0
1961:					
Pin lever	97.5	1.8	.2	.5	0
Jeweled	86.3	5.9	4.4	3.4	0
Total	91.4	4.0	2.6	1.9	.1
1962:					
Pin lever	99.0	.3	.1	.5	.1
Jeweled	83.1	7.2	5.4	4.2	.1
Total	89.6	4.4	3.2	2.7	.1

Exhibit H

B - Bulova H - Hamilton
E - Elgin G - General Time

U. S. Missiles

Mission category		Name	Designation	Cognizant service	System manager/prime contractor	STATUS				AIRFRAME				
						Research	Development	Production	Service use	Assoc. contractor or manufacturer	Max. length, ft.	Max. span, wings or fins, ft.	Body diameter, ft.	Launch weight, lb.
Air-to-air	H	Falcon	AIM-4A	USAF	Hughes	....	....	....	✓	Hughes	6.5	1.7	0.53	120
	H	Falcon	AIM-4C	USAF	Hughes	....	....	....	✓	Hughes	6.5	1.7	0.53	120
	H	Super-Falcon	AIM-4E	USAF	Hughes	....	....	....	✓	Hughes	7.2	2.0	0.55	150
	H	Super-Falcon	AIM-4F	USAF	Hughes	....	....	....	✓	Hughes	6.7	2.0	0.55	145
	H	Falcon	AIM-47A	USAF	Hughes	✓	✓	....	....	Hughes	....	....	....	....
	H	Falcon	AIM-26A	USAF	Hughes	....	....	....	✓	Hughes	7.0	....	0.92	200
	E	Genie	AIR-2A	USAF	Douglas	....	....	....	✓	Douglas	9.0	3.3	1.5	835
		Phoenix	AIM-54A	USN	Hughes	....	✓	....	....	Hughes	....	....	....	....
	BEH	Sidewinder 1A	AIM-9B	USN	Philco	....	....	....	✓	Philco	9.4	....	0.42	155
	BEH	Sidewinder 1C	AIM-9D	USN	Philco	....	✓	✓	....	Philco	9.4	....	0.42	155
	BEH	Sparrow 3a	AIM-7D	USN	Raytheon	....	....	....	✓	Raytheon	12.0	3.3	0.67	400
	BEH	Sparrow 3b	AIM-7E	USN	Raytheon	....	....	✓	✓	Raytheon	12.0	3.3	0.67	400
Air-to-surface	BEG	Bullpup A	AGM-12B	USN	Martin-Maxson	....	....	✓	✓	Martin-Maxson	10.5	3.3	1.0	571
	BEG	Bullpup B	AGM-12C	USN	Martin	....	....	✓	....	Martin	13.6	4.0	1.5	1,785
	BEG	Nuclear Bullpup	AGM-12D	USAF	Martin	....	....	....	✓	Martin	....	3.4	1.1	....
		Condor	AGM-53	Navy	NOTS	✓	....	....	....	....	....	....	....	....
		Hound Dog	AGM-28B	USAF	North American	....	....	✓	✓	NAA	42.5	12.0	2.3	10,000
	E	Quail	ADM-20C	USAF	McDonnell	....	....	....	✓	McDonnell	12.9	5.4	2.5	1,200
	E	Shrike	AGM-45A	USN	NOTS	✓	✓	....	....	....	....	....	....	....
Anti-submarine	B	Asroc	RUR-5A	USN	Minn. Honeywell	....	....	....	✓	Minn. H.-Gen. Mills	15	2.5	1	1,000
	EGH	Subroc	UUM-44A	USN	Goodyear Aerospace	....	✓	✓	....	Goodyear Aerospace	21.0	....	1.75	4,000
Surface-to-air		AADS-70	....	Army	Hughes, Raytheon, RCA	✓	....	....	....	....	....	....	....	....
	H	Bomarc A	CIM-10A	USAF	Boeing	....	....	....	✓	Boeing	47.0	18.2	3.0	15,000
	H	Bomarc B	CIM-10B	USAF	Boeing	....	....	....	✓	Boeing	45.0	18.2	3.0	16,000
	E	Hawk	MIM-23A	Army	Raytheon	....	....	✓	✓	Northrop	16.5	4.0	1.2	1,295
	GH	Mauler	XMIM-46A	Army	GD/Pomona	✓	....	....	....	GD/Pomona	6	....	0.42	120
	EH	Nike Ajax	MIM-3A	Army	Western Electric	....	....	....	✓	Douglas	21.0	4.5	1.0	1,300
	EH	Nike Hercules	MIM-14A	Army	Western Electric	....	....	....	✓	Douglas	41	7.5	2.6	10,000
	EH	Nike X/Zeus	XLIM-49A	Army	Western Electric	✓	✓	....	....	Douglas	48	3.8	6.7	....
	E	Nike X/Sprint	....	Army	Western Electric	✓	....	....	....	Martin/Orlando	....	....	....	....
		Redeye	XMIM-43A	Army	GD/Pomona	....	✓	....	....	GD/Pomona	4.0	0.25	0.25	28
	BE	Talos	RIM-8E	USN	Bendix	....	....	✓	✓	McDonnell	19.0	5.5	2.5	3,000
	BEH	Tartar	RIM-24B	USN	GD/Pomona	....	....	✓	✓	GD/Pomona	15.0	1.7	1.1	1,425
	BEH	Terrier	RIM-2E	USN	GD/Pomona	....	....	✓	✓	GD/Pomona	27.0	1.7	1.0	3,000
Surface-to-surface Strategic and tactical	H	Atlas D	CGM-16D	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	265,000
	H	Atlas E	CGM-16E	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	270,000
	H	Atlas F	HGM-16F	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	GD/Astronautics	82.5	16.0	10.0	269,000
		Mace A	MGM-13B	USAF	Martin	....	....	....	✓	Martin	44.0	22.9	4.5	14,000
		Mace B	CGM-13C	USAF	Martin	....	....	....	✓	Martin	44.0	22.9	4.5	14,000
	BH	Minuteman	LGM-30A	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	✓	✓	Boeing	53.7	....	6	65,000
	BH	Minuteman	LGM-30B	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	✓	✓	✓	Boeing	55.9	....	6	65,000
	BH	Minuteman	LGM-30F	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	✓	✓	....	Boeing	59.8	....	6	65,000
		MMRBM	....	USAF	Hughes[1], AFSC/BSD	✓	✓	....	....	....	....	....	....	....
	BEH	Polaris A1	UGM-27A	USN	Lockheed	....	....	✓	✓	Lockheed MSC	28.0	....	4.5	28,000
	BEH	Polaris A2	UGM-27B	USN	Lockheed	....	....	✓	✓	Lockheed MSC	31.0	....	4.5	30,000
	BEH	Polaris A3	UGM-27C	USN	Lockheed	....	✓	....	....	Lockheed MSC	31.7	....	4.5	30,000
		Taurus	ZRGM-59A	USN	....	✓	....	....	....	....	....	....	....	....
	G	Titan 1	HGM-25A	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	....	✓	Martin/Denver	98.0	....	10.0	220,000
	G	Titan 2	LGM-25C	USAF	AFSC/BSD: Space Tech. Labs.[1]	....	....	✓	✓	Martin/Denver	103.0	....	10.0	330,000
Battlefield support guided missiles		Corporal	MGM-5A	Army	Firestone-Gilfillan	....	....	....	✓	Firestone-Gilfillan	45.0	6.7	3.0	11,247
	H	Lacrosse	MGM-18A	Army	Martin	....	....	....	✓	Martin	19.2	9.0	1.7	2,300
		Lance	XMGM-52A	Army	Ling-Temco-Vought	✓	✓	....	....	LTV	....	....	....	....
	E	Pershing	MGM-31A	Army	Martin/Orlando	....	....	✓	✓	Martin	34.6	....	3.3	10,000
	H	Redstone	PGM-11A	Army	Chrysler	....	....	....	✓	Chrysler	69.0	9.5	6.0	61,700
		Sergeant	MGM-29A	Army	Sperry/Utah	....	....	....	✓	Sperry/Utah	34.5	....	2.6	10,000
	BE	Shillelagh	MGM-51A	Army	Philco/Aeronutronic	....	✓	....	....	Philco/Aeronutronic	....	....	....	....
		TOW	....	Army	Hughes	....	✓	....	....	....	....	....	....	....
Battlefield support—unguided missiles	H	Honest John	MGR-1	Army	Emerson-Douglas	....	....	✓	✓	Emerson-Douglas	25.0	4.5	2.5	....
	H	Little John	MGR-3A	Army	Emerson	....	....	✓	✓	Emerson	15.0	2.0	1.4	776

ABBREVIATIONS: AFSC—Air Force Systems Command; BSD—Ballistic Systems Division; GD—General Dynamics; GE—General Electric; GM—General Motors; lpr.—liquid-propellant rocket; LTV—Ling-Temco-Vought; MIT—Mass. Inst. of Technology; MSC—Lockheed Missiles and Space Co.; NAA—North American Aviation

G=Walleye

POWERPLANT			GUIDANCE		PERF.	
Assoc. contractor or manufacturer	No. of engines, designation, type	Total thrust, lb.	Assoc. contractor or manufacturer	Type	Max. range, naut. mi.	REMARKS
Thiokol	1 x M-58A2 spr.	4,500	Hughes	Semi-active homing radar	5	About 12,000 produced.
Thiokol	1 x M-58A2 spr.	4,500	Hughes	Infra-red	5	AIM-4D was improved version.
Thiokol	1 x M-46 spr.	....	Hughes	Semi-active homing radar	5	More than 2,000 produced.
Thiokol	1 x M-46 spr.	....	Hughes	Infra-red	5	More than 1,200 produced.
Lockheed	1 x spr.	....	Hughes	....	....	
Thiokol	1 x M-60 spr.	....	Hughes	Semi-active homing radar	....	Nuclear warhead.
Aerojet-Thiokol	1 x spr.	....	None	Unguided	....	Also AIR-2B Super Genie.
NAA/Rocketdyne	spr.	....	....	....	....	Major armament for the F-111B (TFX)
Naval Prop. Plant	1 x spr.	....	Philco	Infra-red	....	Used also by USAF, NATO.
Goodrich	1 x spr.	....	Philco	Infra-red	....	AIM-9C has semi-active radar guidance.
Aerojet	1 x 1.8 KS 7800 spr.	7,800	Raytheon	Semi-active homing radar	....	Also used by USAF.
NAA/Rocketdyne	1 x MK 38-MODO spr.	....	Raytheon	Semi-active homing radar	12	Longer range than 7D.
Thiokol/RMD	1 x LR58-RM-4 packaged lpr.	12,000	Martin-Maxson	Command	6	Also used by USAF; 250-lb. warhead.
Thiokol/RMD	1 x LR62-RM-2 packaged lpr.	....	Martin	Command	9	1,000-lb. conventional or nuclear warhead.
Thiokol/RMD	1 x LR58-RM-4 packaged lpr.	12,000	Martin	Command, offset capability	....	Lengthened body for nuclear warhead.
....	....	....	....	....	....	In early development for F-111.
Pratt & Whitney	1 x J52-P-3 tj.	7,500	NAA-Autonetics	Inertial	600	Air-launched from Boeing B-52G.
General Electric	1 x J85 tj.	....	McDonnell	Autopilot	200	Air-launched from Boeing B-52 as decoy.
NAA/Rocketdyne	spr.	....	Texas Instruments	....	....	Anti-radiation (electromagnetic) missile.
Naval Prop. Plant	1 x spr.	....	....	Unguided	....	To be replaced by new, longer range, ASW weapon now under development.
Thiokol	1 x spr.	....	General Precision	Inertial	....	Fired from submerged sub.
....	....	....	....	....	....	To replace Nike Hercules and Hawk.
Marquardt	2 x RJ43-MA-3 rj.	10,000	Westinghouse	Active homing radar	200	A model to phase out of operation in 1964.
Marquardt	2 x RJ43-MA-11 rj.	24,000	General Precision-Westinghouse	Active homing radar	400	Thiokol spr. booster with 50,000-lb. thrust; nuclear warhead only.
Aerojet	1 x XM-22E8 spr.	....	Raytheon	Semi-active homing radar	22	Also for USMC and NATO; anti-tactical ballistic missile version under study.
Lockheed	1 x XM-107 spr.	....	GD	Semi-active homing	....	Mobile weapon. Mauler development dropped.
Aerojet	1 x lpr.	2,600	Bell Tel. Labs.	Command	25	Hercules spr. booster.
Thiokol	1 x M-30 spr.	....	Western Electric	Command	75+	Hercules spr. booster.
Thiokol	3 x spr.	450,000	Western Electric	Command	100	ICBM high-altitude intercept missile.
Hercules	spr.	....	Bell Tel. Labs.	Command	30	ICBM low-altitude intercept missile.
Atlantic Research	1 x spr.	....	GD/Pomona	Infra-red	....	Fired from infantryman's shoulder with "bazooka" launcher. Also for USMC.
Bendix	1 x rj.	....	Sperry	Beam-rider; s-a homing	65	Also for surface-to-surface missions; Hercules spr. booster.
Aerojet	1 x spr.	....	GD/Pomona	Semi-active homing	10+	Dual-thrust, dual-grain rocket motor.
Hercules-Atlantic Research	1 x spr.	....	GD/Pomona	Semi-active homing	10+	Hercules spr. booster.
NAA/Rocketdyne	2 x LR89-NA-3 lpr. 1 x LR105-NA-3 lpr.	300,000 57,000	GE/Burroughs	Radio-inertial	9,000	GE Mark 3 re-entry system. Two lpr. verniers add 2,000-lb. thrust to Atlas D, E & F models.
NAA/Rocketdyne	2 x LR89-NA-5 lpr. 1 x LR105-NA-5 lpr.	330,000 57,000	Arma	Inertial	9,000	Avco Mark 4 re-entry system; semi-hard launch sites.
NAA/Rocketdyne	2 x LR89-NA-5 lpr. 1 x LR105-NA-5 lpr.	330,000 57,000	Arma	Inertial	9,000	Avco Mark 4-re-entry system; underground silo launch.
GM/Allison	1 x J33-A-41 tj.	5,200	Goodyear-Emerson	Atran (Auto. terrain recog. & navigation)	650	Fired from mobile trailer/launcher.
GM/Allison	1 x J33-A-41 tj.	5,200	GM/AC Spark Plug-General Mills	Inertial	1,200+	Fired from hardened, fixed sites.
Thiokol (1st stage) Aerojet (2nd stage) Hercules (3rd stage)	1 x XM-55 spr. 1 x spr. 1 x spr.	260,000	NAA/Autonetics	Inertial	6,300	Wing 1; Avco Mark 5 re-entry system.
Thiokol (1st stage) Aerojet (2nd stage) Hercules (3rd stage)	1 x spr. 1 x spr. 1 x spr.	....	NAA/Autonetics	Inertial	6,300	Wings 2-5; titanium second stage.
Thiokol (1st stage) Aerojet (2nd stage) Hercules (3rd stage)	1 x spr. 1 x spr. 1 x spr	....	NAA/Autonetics	Inertial	6,300	Wing 6; single secondary injection nozzle 2nd stage.
Thiokol (1st stage) Thiokol (2nd stage)	1 x spr. 1 x spr.	....	General Precision	Inertial	....	Mobile mid-range ballistic missile.
Aerojet (1st stage) Aerojet (2nd stage)	1 x spr. 1 x spr.	....	GE-Hughes	Inertial	1,200	Guidance system designed by MIT; aboard George Washington class submarines.
Aerojet (1st stage) Hercules (2nd stage)	1 x spr. 1 x spr.	....	GE-Hughes	Inertial	1,500	Aboard Ethan Allen class submarines.
Aerojet (1st stage) Hercules (2nd stage)	1 x spr. 1 x spr.	....	GE-Hughes	Inertial	2,500	Also improved B-3 in program definition stage.
....	....	....	....	....	....	Ship-launched landing force support weapon.
Aerojet (1st stage) Aerojet (2nd stage)	1 x LR87-AJ-3 lpr. 1 x LR91-AJ-3 lpr.	300,000 80,000	Bel Tel. Labs-Rem. Rand	Radio-inertial	6,300	Avco Mark 4 re-entry system; silo storage; surface launch.
Aerojet (1st stage) Aerojet (2nd stage)	1 x LR87-AJ-5 lpr. 1 x LR91-AJ-5 lpr.	430,000 100,000	GM/AC Spark Plug	Inertial	6,300	GE Mark 6 re-entry system; underground silo launch; storeable propellants.
Ryan	1 x A1 lpr.	20,000	Gilfillan	Inertial	75	Also used by British Army.
Thiokol	1 x M-10E1 spr.	....	Martin/Orlando	Command	20	Shaped-charge or nuclear warhead.
Rocketdyne	2 x packaged lpr.	....	LTV	Simplified inertial	....	Replacement for Honest John & Lacrosse.
Thiokol (1st stage) Thiokol (2nd stage)	1 x XM 105 spr. 1 x XM 106 spr.	....	Bendix/Eclipse Pioneer	Inertial	400	Replacement for Redstone.
NAA/Rocketdyne	1 x A-7 lpr.	75,000	Sperry Farragut	Inertial	250	Deployed with U.S. Army units in Europe.
Thiokol	1 x XM-100 spr.	45,000	Sperry/Utah	Inertial	75	Replacement for Corporal; 1,500-lb. nuclear warhead only.
....	1 x spr.	....	Philco/Aeronutronic	Command	....	Tank-mounted, anti-tank missile; fired by 152 mm gun launcher.
Hercules	K-41 spr.	....	....	Wire	....	Anti-tank missile.
Hercules	1 x M-31A1 spr.	....	....	Unguided	13	Also with NATO armies.
Hercules	1 x M-26 spr.	....	....	Unguided	10+	Nuclear or conventional warhead.

NOTS—Naval Ordnance Test Station; rj—ramjet; RMD—Reaction Motors Division; spr.—solid-propellant rocket; tj—turbojet; †—AFSC/BSD is program manager: company is systems integration contractor.

STATEMENT OF R. L. ADAMS TO THE OFFICE OF DEFENSE MOBILIZATION, JANUARY 7, 1957

I graduated from the U.S. Naval Academy in 1925 and served at sea in battleship and destroyer types from 1925 to 1932. My duties during this period dealt principally with ordnance and gunnery. From 1932 to 1935 I was a student at the U.S. Naval Postgraduate School at Annapolis, specializing in ordnance. The last half year of this period was spent as an observer at various naval stations and industrial firms engaged in production of naval ordnance items. From 1935 to 1938 I served at sea in a destroyer as gunnery officer. From 1938 to 1941 I was the field inspection officer for the Inspector of Naval Material, Pittsburgh district. During the period I had intimate contact with manufacturers of many items varying from armor, projectiles, wood products, aluminum products, knitting mill products, etc. From 1941 to 1944 I served at sea in cruiser and amphibian type ships in various capacities. From 1944 to 1946 I was the Inspector of Naval Material, Bethlehem, Pa., which again required intimate contact with manufacturers of many items, both large and small, simple and complex. From 1946 to 1949 I served at sea in various capacities.

From 1949 until June 30, 1955, some 18 months ago, when I retired from the Navy and joined Lyon, Inc., of Detroit, as head of their new products division, I was assistant chief of the Bureau of Ordnance for Material. In this position with the bureau, I was in charge of procuring all munitions for the Navy, including naval ammunition of all types; aviation ordnance equipment; guided missiles; guns, gun mounts, and missile launchers; naval mines; torpedoes, etc. The Navy also had responsibility, exercised through my office, for the procurement of material for other services, including procurement of rotating-type proximity fuses for the Army and Marines and air-to-air and air-to-ground rockets for the Air Force. In this assignment I had firsthand knowledge of the role of the jeweled watch and other industries as suppliers of Bureau of Ordnance requirements.

Historically, the watch industry has long been a prime source of supply for small, precision-built ordnance items and components. This is especially true of complex fuse mechanisms and safety and arming devices, of which many types and tremendous quantities were produced for the armed services during and since Korea. I believe it was just 7 months ago today that Commander Gichner testified before a subcommittee of the Joint Economic Committee on one facet of the Navy's experience in dealing with the jeweled watch companies—i.e., the procurement of proximity fuses from these companies and from others during the critical days of the Korean war. Mr. Gichner was my assistant, in charge of the VT fuse program. I have read his prepared statement and have a copy here which I would request be incorporated into the record. I might add that his recitation of the facts of this crash program accords in every detail with my own recollection, and I wholeheartedly endorse the conclusions he draws from those facts.

Why does the Navy turn to the watch industry for these and many other types of complex fuses and safety and arming devices? To anyone connected with the procurement of these items, the answer is at once so simple and obvious that one wonders why the question has not long ago been put to rest. Where very small, precise, accurate, compact, rugged, and reliable mechanisms are called for—in quantity and in the shortest possible time—we have found again and again that the jeweled watch industry is uniquely suited for the job. It has the necessary combination of equipment, skills, and experience to attain quick production in both the quantity and quality required.

We have also found that the nonjeweled watch and clock industry is a necessary source, particularly because it has productive capacity to supply the necessary volume of many items. We have found that these industries have a type of equipment and a native skill which very definitely sets them apart from other industries as procurement sources for the type of material I have mentioned. This should surprise no one, since those equipped and trained in a special field normally excel in that line of activity. Other industries might produce the type of material if given the equipment and the time required. There is little if anything that American industry cannot produce, given sufficient time, proper equipment, and ample funds. The very nature of military procurement, however, is such—particularly in view of our ever-changing weapons technology—that these are luxuries we cannot afford. And this, of course, is especially true of periods of rapid mobilization.

It is dangerous to generalize that the precision instrument industry could supply the material traditionally obtained from the horological industry, because it has not proved so in practice. Even well-managed and eminently successful instrument companies have failed completely to meet the needs of the Navy in the watch industry's field. As one example, I recall that during the Korean war when the Navy was concerned with the adequacy of its fuse production base, we furnished at Government expense a complete plant and the equipment necessary to produce a much-needed fuse to a reputable instrument manufacturer in the New York area. Despite that company's excellent background and performance in precision instrument manufacture, it experienced the greatest of difficulties in converting to this new item, and was never able to produce.

I can say categorically, in fact, that as far as the fuses which we purchased are concerned, we could not have gotten along at all without a watch industry during Korea. Other companies were later brought into the program because watch industry capacity was not sufficient to meet the services' requirements. It was the watch industry, however, that got our fuse program started, that worked the bugs out of the designs, that set up the production and processing procedures. Had we not had a watch industry to fall back on, we would have had to have fought this war without or with only token quantities of this critical item. And even when we were able to get other suppliers into production, in no instance that came to my attention was a jeweled watch company outperformed in terms of quality by a company outside the jeweled watch industry.

The performance of the watch companies in product engineering alone would render them indispensable. In times of pressure, it becomes necessary to get into production on new items which have not been fully engineered. In many instances we have supplied these companies with drawings (or in some cases rough prototypes) of complex, new ordnance items and asked them to produce prototypes or pilot-line quantities. More often than not, the designs are incomplete, and furnished prototypes sometimes do not conform to basic drawings. The watch companies can take these incomplete plans, make the necessary changes in the design of the mechanism to improve its performance and reliability, and cut its cost of manufacture. Frequently, the companies have simplified existing models to such an extent as to permit their ready manufacture by nonwatch companies. During the Korean war, for example, we had an almost overnight requirement for millions of fuzes for 2.75-inch air-to-air rockets. No jeweled watch company had made this fuse, nor had they been scheduled to make it. Yet we called upon the watch industry to produce over 3 million of these fuses—again as a result of our experience in procuring similar items from the industry in the past and our knowledge of their present capacity and abilities to achieve rapid production of a complex quality item of this type. We have come to regard the jeweled watch industry as our best outside source for production engineering of miniature, dependable, and complex mechanisms.

I have talked so much of the watch industry's performance in the fuse program during the Korean emergency only to illustrate the need for the kind of job it can do during times of crisis. But no one should suppose for an instant that the changing nature of our armament has lessened this need. Quite the contrary: The capabilities of the jeweled watch industry are of extreme significance in our present-day weapons program. It is not by accident that the watch industry is so involved in practically all of our missile programs. Perhaps now, more than at any prior time in our history, we are going through a period of continuous refinement—of testing and retesting, evaluation and reevaluation—of new weapons and weapons types. This process has been accompanied by a concerted effort to make things both smaller and more reliable. With these dual objectives in mind, we have found it necessary to substitute mechanical and electromechanical devices for certain electronic gear in our missiles.

This constant technological evolution certainly illustrates the impracticality—if not the folly—of placing undue reliance upon a static concept of future M-day requirements. We will be required more and more frequently to procure new items in shorter periods of time and with less preliminary engineering. We just do not know today what will be the prime weapons in our arsenal a year or two from now.

I would like to add a word about capacity. Even if the watch industry were not unique in its performance capabilities, its productive capacity alone would be indispensable. During the height of our Korean fuse program, we found that there was a great shortage of certain horological machinery. The capacity of the watch companies to supply parts to other producers that had been pulled into the program was so inadequate that we had to purchase millions and millions of pinions from Switzerland. To remedy this, the Government has bought and has on hand several million dollars worth of new special purpose machinery. But in my judgment it would be practically useless in time of need if there were no watch industry to operate it. What the services need is a larger watch industry. We should never be dependent upon European sources for this type of material.

In my judgment and because of the factors I have mentioned we will come to place even greater reliance upon the watch industry for the supply of many of our most critical weapons components—both in the development and refinement of new types and for the volume production of types settled upon and selected to be operational. In view of this and of my personal familiarity with the vital contributions the industry made to our military preparedness during the Korean war, I cannot consider the present weakened condition of the jeweled watch industry in this country as anything less than an extremely dangerous threat to our national security.

STATEMENT OF JACOB H. GICHNER BEFORE THE SUBCOMMITTEE ON FOREIGN ECONOMIC POLICY, JOINT COMMITTEE ON THE ECONOMIC REPORT, JANUARY 7, 1956

Mr. Chairman and members of the subcommittee, my name is Jacob Gichner. I am a mechanical engineer by profession, having received my B.S. degree from Lafayette College in 1924 and my master's degree in mechanical engineering from the same school in 1926. I was engaged in the metals and later the mining business during the period preceding World War II. In 1942, I was commissioned by the U.S. Navy and assigned to the Bureau of Ordnance as assistant to the head of their ammunition program. I left the Navy with the rank of commander in 1946 and worked for private industry as a mechanical engineer until 1949 when, at the request of Admiral Noble, Chief of the Bureau of Ordnance, I put in a temporary 6-month tour as acting head of the Navy's ammunition program. As a part of this assignment, I was asked to review, evaluate, and prepare a report on the Navy's ammunition program in the years following World War II.

In December 1950 I was recalled to active duty in the rank of commander and placed in charge of the proximity (VT) fuse program, a position I held until July 1952 when I reverted to Reserve status. From then until June 1953, I was employed by the Ronson Corp., in Newark, as head of their engineering and research department. In June 1953, I left Ronson to establish my present machine tool and equipment retail business here in Washington.

I appreciate the committee's invitation to appear before it and the opportunity it affords me to relate something of the experience of the military in the procurement of the proximity fuse during the Korean conflict. I accepted the committee's invitation because I feel that much has been publicly said in the past with respect to the relative role of the watch companies and others in fuse production that simply does not accord with the facts as I know them. I have no personal stake or interest whatsoever in this question. I do feel sincerely that the record, at least as to Korea, needs to be made straight and I assure you, gentlemen, that is my sole purpose in appearing before you today.

I might explain at the outset that, according to the then existing division of responsibility between the services, the Navy was charged with the procurement of rotating fuses of all types for the Army and Marines, as well as for its own forces. The Army, in turn, had responsibility for procuring nonrotating fuses for each of the services. In the rotating fuse family the proximity fuse was by all odds the most important and was, and still is, one of the prime tactical weapons in our arsenal of ammunition types. During the Korean war, the Navy procured for the Armed Forces millions of these fuses at a cost of over $1½ billion.

In December 1950 when I was given responsibility for coordinating and expediting the rotating proximity fuse program for the Navy, the safety and arming devices for these fuses were being obtained exclusively from the Naval Ordnance plant in Rochester, N.Y., which was operated by Eastman Kodak under a long-standing management contract with the Navy. It was on November 26, you will recall, that the Communist forces launched a powerful counterattack from the Yalu. By the end of December they had forced the evacuation of

105,000 United Nations troops from Hungnam. These were bleak days. The decision was made almost immediately (in January 1951) to expand fuse production and broaden our source-base. At that time, there were on the mobilization list of planned producers of safety and arming devices for rotating proximity fuses 12 companies—the 4 jeweled watch manufacturers and 8 other firms outside the jeweled-watch industry, which firms are well known to this committee.

Based upon the record of past performance of these companies, comparative prices and upon the estimates of our engineers as to their respective abilities to deliver, we selected five companies (Hamilton, Elgin, and Bulova, and two outside the jeweled-watch industry) and in February awarded letters of intent to each. Each company was given almost identical orders in terms of quantities and was supplied with plans, models, and parts. From that point on, the record, I believe, is revealing.

First, as to delivery performance. The first deliveries received under this crash program were received from the Elgin National Watch Co. in October or November 1951. The next company to deliver acceptable lots was the Hamilton Watch Co. in January 1952. Hamilton was followed by the Bulova Watch Co. in February. When I left the Navy in July of 1952, some 17 months after orders were placed, neither of the other two companies had been able to deliver a single lot of acceptable safety and arming devices for proximity fuses to the Armed Forces. On at least two occasions I visited the plant of one of these latter companies in an effort to assist them in getting into production, and at one point, I recommended canceling the company's contract outright because of its apparent inability to overcome production difficulties. Several months after the contracts were awarded, the other of these two companies found it necessary to completely reengineer its production facilities from scratch.

At the beginning of the program it was found that in many cases drawings had to be changed and deviations allowed because the plans and drawings received from Rochester had not been brought up to date at the time they were transferred to the other companies. When these changes were authorized they were issued by means of change orders to all of the companies in the program so as to insure standardization of product. Once the original lots were accepted from each of the jeweled watch companies, requests for deviations and waivers from those companies were kept to a minimum.

Next, as to quality. Under procedures then in effect, 12 fuses from each lot of 3,000 produced were subjected to firing tests at the Army Proving Ground at Dahlgren, Va. If a single round out of these 12 failed, 36 more rounds from the same lot were tested. If there were any failures in this group the lot was rejected. And, incidentally, since each of these rounds alone cost the Government approximately $50, not to mention the other costs of firing, refiring was an extremely costly process. In addition to the firing tests, each lot was put through what we call a "jolt and jumble" test. Based on the reports received by me, the reject rate on fuses containing safety and arming devices produced by the jeweled watch companies was lower than that on fuses containing devices produced by the other two companies. Actually, the first several lots received from the two companies outside the jeweled watch industry were found unacceptable by these tests. In my judgment, both of these companies were more production conscious than quality conscious—and this no doubt accounts in no small part for their inability to deliver initial lots that were acceptable to the military. At one point, I recall, we tested over a hundred consecutive lots from the jeweled watch companies without a single fuse failure.

Finally, as to price. The lowest prices paid by the Government for fuses under this program were charged by the Elgin National Watch Co. Elgin was followed, in order of costliness, by Bulova, Hamilton, and finally by the other two companies. It is interesting to note that while the aggregate of the costs going into the manufacture of proximity fuses had almost doubled since World War II, the military was able to obtain these fuses during the Korean war at considerably less than World War II prices. Furthermore, as the program got underway, the companies were able to reduce somewhat their prices to the Government.

I would prefer not to draw any conclusions from the foregoing. I think the experience speaks for itself. I do feel, however, that the achievement of the jeweled watch manufacturers during the Korean war is undoubtedly attributable to their continual commercial concentration on the production of close tolerance, precision-made, high-quality parts. Others can and have produced parts for proximity fuses and equivalent military instruments. The Korean experience certainly indicates to me, however, that where mass production of new military items of the proximity fuse type are urgently in need, the jeweled watch industry is likely (1) to require much less leadtime, (2) to turn out a superior product, and (3) at equivalent or less cost.

STATEMENT OF LEWIS E. MASSIE

My name is Lewis E. Massie. I am senior design engineer and approvals examiner, electrical, for General Dynamics Corp., Convair Division. I am here as an official representative of my company, for reasons which I shall explain. In my present capacity with my company, it is my job to approve customer-furnished electrical products for use in airplanes manufactured by Convair—San Diego. As a part of this responsibility, it is my job to approve every specification for these products, to go through plants which we are considering as sources, to recommend the best sources in accordance with their capabilities, and to approve the qualification of the product obtained from that source.

I have been engaged in the engineering business since 1935. From 1935 to 1944 I was an engineer successively for Convair, Boeing, Douglas, Hughes Aircraft, and Lear, Inc. From 1944 until 1951 I conducted my own business in the design and manufacture of electromechanical components. From 1951 until I returned to Convair in early 1956 I was project engineer and assistant to the director of engineering at Billjack Scientific Co.

In these various capacities I have been intimately associated with a great many American manufacturers of various components and have inspected their facilities. I have visited many plants of all types including those involved in precision manufacturing. In fact, I have visited practically all the companies in the United States that produce in the fields of interest to the aircraft industry.

Convair, as a U.S. Government prime contractor, is interested in locating and developing every potential source of assistance in solving some of the fundamental problems which face every airframe manufacturer. Basically, these are needs for reductions in weight and size and increases in precision and reliability, while maintaining or improving compatibility with environmental conditions such as shock, vibration, altitude, temperature, etc. In short, Convair, like every other airframe manufacturer, has an urgent need for miniaturization.

I would like to be very specific about what we mean when we say miniaturization. The increased requirement for complete automation under flight conditions for aircraft and missiles has increased the amount of avionic equipment to the extent that ultimate performance is severely handicapped by space and weight requirements. Miniaturization we know will reduce weight and size, increase resistance to vibration and shock, maintain or reduce temperature problems, and possibly increase reliability.

There are three possible approaches to miniaturization: (1) Repackaging of available components into higher density enclosures, which saves very little weight and increases service problems and heat problems; (2) shrinking of present designs, which is, basically, making smaller parts for an existing design. This is usually limited to decreasing size by eliminating design factors and increasing the use of very close tolerances. For our suppliers, in general, this is unsatisfactory because quality control problems, already very great, are merely increased, and in consequence reliability suffers: (3) complete new design incorporating new techniques and new materials which result in a smaller product which at the same time is simpler, equally or more reliable, and preserves the resistance to environmental conditions. This is true miniaturization. One of the reasons Convair believed it important to appear here today was to emphasize the need for this, the ultimate type of miniaturization. We are concerned about this need as a matter of principle and not because we have a special interest in any one of the jeweled watch companies.

The ability of most manufacturers to effect this degree of miniaturization is quite limited. Their engineers and designers do not have the necessary know-how. Their machinery and tooling is not adequate and they do not have the ability to construct the special machinery called for by new and smaller designs. They are unable to finance the additional learning curve, which, simply stated, is the time required to train personnel and develop facilities for the production of new and smaller designs. Under these circumstances, they are reluctant even to consider specifications requiring redesign for miniaturization. Many of them are having difficulty in maintaining the quality of the components designed for their present manufacturing facilities and techniques.

Aircraft engineers are concerned primarily with systems—obtaining a desired result from a complex of components. We do not have in our company or in our industry the manpower necessary to establish aircraft engineering design specialists for every type of component. Our aircraft engineers must prepare procurement specifications and order from component manufacturers to these specifications, or we must initiate development contracts with subcontractors. Thus, aircraft engineers are completely dependent upon other industries for development and manufacture of miniaturized components. Our problem in procurement from these sources is that our leadtimes are extremely critical, and we do not have time to go to manufacturers who do not have the necessary experience and to assist them in developing adequate techniques. We must have manufacturers who already possess the know-how required to reduce our leadtimes or hold them to an absolute minimum.

We are constantly haunted by this problem of inadequate sources for new miniature designs. It is one of the major restrictions upon the aircraft industry. It is for this reason that our company was astounded to learn that the U.S. Government might even consider permitting the loss or reduction of the facilities of the American watch industry, which are the most advanced outpost of precision miniature products.

It might be interesting to note, at this point, that, during the search for new sources for a miniaturized program timer on a current missile contract, our engineers were amazed and pleased at the advance design qualities of a miniaturized unit proposed by an American watch manufacturer. The design concepts and manufacturing techniques in this unit were several magnitudes above those proposed by other component manufacturers.

I personally first visited the facilities of one of the American watch manufacturers after I had seen the Neomite relay. It is the smallest relay of which we have any knowledge. I analyzed it and found that despite its size it met the manufacturer's advertised specifications completely. I then wanted to know whether this was a watchmaker's handmade sample or whether it could be reliably manufactured on a mass production basis. I visited the plant of the Elgin National Watch Co. at Elgin, Ill., along with a senior group engineer for one of our current jet fighters. As I said before, I have visited hundreds of plants, but in my experience this facility was unique. I had seen other manufacturers in the precision field buy Swiss high-speed precision machinery only to find that they did not possess the know-how to use it. At Elgin we found a complete facility which operated not only these machines but further advanced machines of their own design and manufacture, on a mass basis on extremely small parts to very close tolerances. Furthermore, we noted that their quality control was maintained at a surprisingly high level. They had the ability to develop and produce their own machines and tooling. (I pause here to mention, that, in my judgment, in the event of a real emergency the toolmaking facilities of the watch industry migh well be needed in their entirety to teach other people how to build the machinery which we would so badly need.) We were both impressed with their research experience in semiconductors and miniature batteries. Their ability to respond to their own needs was further demonstrated by the development of specialized lubricants. In their field they could talk with complete confidence and were unlike many other companies who promise anything and can't deliver, or who immediately reject such tolerances as impracticable. With respect to the studies we requested, Elgin's engineers offered to and did furnish us with reports which demonstrated what they knew by suggesting to us several approaches that were enthusiastically received by our own engineers. We have now developed a liaison between our company and Elgin.

At this point, I would like to emphasize as strongly as possible that electrical miniaturization is strictly a mechanical problem. It is the mechanical abilities of the watch companies in the miniature field which we regard as so important. We recognize that they are not the leaders in the field of electronics, but the mechanical faculties which they possess—and by faculties I refer to both know-how and manual dexterity—are essential to true miniaturization in the electronics field just as it is in the mechanical field.

The watchmaking skills cannot, in my judgment, be maintained and implemented in their needed intgerity by diversification into other products. Their versatility and application in many different directions depends upon their basic day-to-day application in watch manufacture. Furthermore, we believe that competition among the watch companies on watch manufacture will maintain their efficiency. We in the aircraft industry will most certainly increase our use of these skills, but that will be only a temporary advantage unless the fundamental production in which the skills were learned and upon which they depend is preserved. I view the watch industry as a spring of talent which should be drawn upon but not dried up by diversion of all its activities into other special endeavors.

I would like to emphasize also that in stating that the faculties of the American watch industry are unique I am speaking from 20 years of practical experience in the design, development, and manufacture of electromechanical components. I was myself engaged directly for 5 years in the production of small, high precision aerial cameras which involved some close precision shop tolerances. And without mentioning names of any companies, I have had close connection with many concerns in the precision field. When we take a problem in miniaturization to these companies, they either tell us why it can't be done or say that we had better use some current technique and process. It is against this background that we have seen fit to appear to state that in our opinion any failure on the part of the Government to preserve the watchmaking skills as a part of our national security would be dangerously shortsighted. We as engineers, have not been able to understand how the matter can be seriously debated.

Statement of Dr. C. S. Draper, Office of Defense Mobilization, January 7, 1957

My name is Charles S. Draper. I took my doctor of science degree at MIT in physics, and have since spent most of my time in research, much of it of military interest. In the 1920's I ran a laboratory to develop infrared signaling devices for the Navy. Since 1939, I have been a full professor at MIT, and am now head of its department of aeronautical engineering, and director of the instrumentation laboratory. I have recently spent considerable time on programs devoted to the development of advanced military weapons systems.

I have been asked to appear at this hearing on the defense essentiality of the jeweled watch industry to present the viewpoint of an engineer working in the field of measurement control. My qualifications for discussing anything connected with the watch industry are not based on a detailed knowledge of written agreements, laws, or statistics, but rather depend on some years of intimate contact with the design, engineering, and manufacture of high-precision mechanical devices, including watches, and with men who have elected to devote their lives to this field.

It appears that the fundamental question to be answered is whether or not a healthy jeweled watch manufacturing industry is essential to our national security. This question must be studied in terms of the contributions made by our watch companies to the peacetime prosperity and the wartime safety of a United States that must live in the modern world. Living in this environment means that we have to deal with countries made up of men having all the motives and reactions to be expected of human beings, so that we must continually keep our guard up in supporting our industries well enough to weather any emergency that may arise to disturb our national existence. It is my opinion that the watch industry is an essential element of our industrial system in both peace and war and should be given whatever support is necessary to insure its good health.

Modern warfare, whether of the all-out or the "brush fire" variety, is dependent on very close timing of the actions of cooperating organizations. This means that almost all individuals in the Armed Forces must have good watches and that the attrition rate of these watches will be correspondingly high after action begins. This situation will be especially serious for the very accurate timepieces that are essential for the precise navigation of moving vehicles on the land, on and under the sea, and in the air. It may be argued that any future war will be over in such a short time that only stockpiled watches will be useful and no manufacturing backup could help the ability of our country to defend itself. This statement is certainly not true for "brush fire" wars and would also probably not hold for the "finishing up" phases of any all-out war. If America allows herself to be caught in a position of entire dependence on watch imports that may be cut off by an enemy, severe handicaps would in all probability be imposed on our fighting forces.

In addition to the high quality timepieces it produces, the watch industry provides a great capability for manufacturing the many small parts of high precision that are used in the instruments and controls for our aircraft, ships, guided missiles, fire control systems, and other modern defense devices. This ability to manufacture small parts depends on the fact that the American watch industry has carried its methods and equipment to a very high degree of automation. With the automatic machines that they have available, watch companies are able to quickly start quantity production on small precision parts for other industries, in the case of an emergency, while still maintaining a reasonable output of watches for military requirements.

From my own experience, I believe that the watch industry is particularly well qualified for quantity production of rugged, high performance gyro units of the small size best suited for guided missiles, manned aircraft, autopilots, and airborne fire control systems. For example, one watch company proved that they could supply a special type of jewel bearings for tiny gyrorotors. This opened up new operational possibilities that had not up to then been thought possible.

Another indication of the potential contribution from the watch industry is shown in our own laboratory in the case of men who have had previous watchmaking experience, and the mental attitude and dexterities associated with this kind of work. We have found that these men, trained as watchworkers, have been effective in making small gyro units within our laboratory, whereas technicians without the watch experience proved to be generally unsatisfactory.

I have heard it argued that an American watch industry in being is unnecessary, because personnel and equipment could be shifted from other areas and almost immediately start up watch production and related high-precision design, engineering, and toolmaking operations from scratch. In my opinion, this is a false hope because no other industry requires the same abilities and training as those that are necessary to set up the machines for manufacturing watch parts and to supervise the personnel in assembling and finishing watches.

On the basis of past experience with watch production facilities, it is to be expected that, beginning with an empty plant, 2 to 10 years would be required to recreate an organization and start putting the complex skills, know-how, and machines necessary to make high-quality watches into effective operation. The variation between these estimates depends on how much of the necessary equipment exists in storage and how many men with previous experience in watch factory work can be found. The short time of 2 years for beginning operation could be achieved only by drawing together resources in equipment and personnel from recently shutdown plants. With both machines and people from previous watch manufacturing organizations dissipated, it might well take all of 10 years to realize high-quality watch production in any reasonable quantities.

The truth of this statement may be measured in terms of the experience of England, where the fine watch industry was allowed to die and is only now being brought back to healthy existence after the expenditure of much effort, money, and time. I wish to enter my plea that we do not let the American watch industry go through the sad experience of its English cousin.

REPORT ON THE ESSENTIALITY OF THE WATCH INDUSTRY TO THE DEFENSE OF THE UNITED STATES BY C. LEIGH STEVENS, JUNE 5, 1957

We were requested by the Office of Defense Mobilization to report upon the essentiality of the watch industry to the defense of the United States.

This request stemmed from the fact that the watch industry had petitioned under section 7 of the Trade Agreements Extension Act for a finding of essentiality, which section, in effect, says that upon a finding by the Office of Defense Mobilization that an industry is essential to the national security (defense) of the United States and upon confirmation of that finding by the President, then the President may take whatever action he deems fit to protect that industry in order that it may properly discharge its responsibility to contribute to that national security (defense).

The section makes no mention of economics, foreign relations, international friendships, trade balances, or any of the other facets of foreign or domestic manufacture of physical things for the American market. It uses the phrase "national security."

Yet, in the context of the discussions so far, one cannot but arrive at the conclusion that defense of the United States has been given lip service only, and the discussions run far afield into productive costs, costs of living, efficiencies of manufacture, standards of living, tariffs, or what have you, and that the single simple fact of the ability to make a physical unit or component needed in the overall defense syndrome has been completely obscured. Since the size of the physical units which the watch industry makes as a matter of course have such a bearing on the problem, it might help in the understanding of the problem to look for a moment at the makeup of American industry in relation to the physical size of its products. A simple curve brings this crystal clear. A 60,00-kilowatt generating unit is illustrative of very large size of piece. Three or four plants have the capability of making them such as General Electric, Westinghouse, and Allis Chalmers.

Since it is easily understood that power is essential and the great size of the pieces involved in big generators is so visually apparent, the essentiality of the plants to make them is visually determined and is unquestioned.

As the size of the individual piece being manufactured decreases, the number of plants engaged increases rapidly; great crossflows of capabilities take place until you begin to reach miniature sizes, and at the very small sizes of pieces of high precision you again find a very few plants such as Hamliton, Elgin, and Bulova. But here you need magnifying glasses to see, and visual determination is not so easy—the essentiality is there, and why is it there? Because in our defense many of the vital instruments or weapons systems of defense are airborne. Because of this fact, therefore, if you can reduce the size of a vital part in its lineal dimensions by one-half, then you reduce its volume to one-eighth—i.e., 2 by 2 by 2 equals 8, 1 by 1 by 1 equals 1—and volume is the basic problem of airborne devices.

And this problem of reduction in size can only be properly attacked by organizations in being who understand and work with small sizes and whose equipment is in daily use in that field.

Of course, by the use of job descriptions you can come up with interchangeable skills—toolmaker for toolmaker, machinist for machinist, engineer for engineer. But a mere collection of skills in and of itself can produce nothing. They must be welded into an organization in being—managed, controlled, and directed.

This is so apparent in every walk of life that, to find serious consideration being given to allowing proven organizations in being to die or be put in mothballs on the basic premise that because skills are interchangeable they (the organizations) can be reconstituted, willy-nilly, is amazing.

You don't have a church because you can collect a pastor, some deacons, and ladies aid until you weld them into an organization in being. You don't have a school through the collection of scientists and teachers, no matter how brilliant, until they are made into a functioning organization that become an educational institution. You don't fly a B–52 bomber with a collection of pilots, navigators, etc., until, by long, hard, arduous training, you have teamed those skills into an organization in being.

As one enters upon the study of this problem and becomes familiar with the building of new buildings, organizations, etc., for the defense effort and one sees the Sunday New York Times ads for engineers of all kinds and realizes the tremendous forces being exerted to destroy organizations in being by uprooting their personnel to form new untried organizations, you become amazed that it can happen.

And when you get to the watch industry specifically you realize how essential to defense that industry is in its field of small manufacture and how much it can and has contributed.

Four specific instances are more than sufficient to prove the point:

1. The case of the T–336 mortar fuse mechanism which Bulova is now making on a directed procurement from Picatinny Arsenal.

There are a great number of mortar fuses of this type in stock. Unfortunately, they are imperfect to a great enough degree that their use in peacetime maneuvers, due to personnel casualties, is highly undesirable.

In August 1956 a directed procurement was given to Bulova for a new mechanism based on Frankfort Arsenal's design. There have been many changes (approximately 90) in the details of that design in order to produce the mechanism in quantity; 5,000 will be delivered in June and 170,000 in July, and peacetime maneuvers can be carried on without the danger to personnel that exists in those in stock.

Certainly, no new organization collected together would have even gotten really started, and secondly, no amount of rationale can gainsay the fact that when the problem arose a watch company was in being of proven capabilities who could and did pick up the load, for the problem was in their field.

No amount of speeches can change the fact that the approach to this problem was in every way correct, and that because of the existence of these problems in the field of small manufacture filled by the watch industry then the watch industry is essential for their solution.

2. A second case lies in the field of Elgin's entering the electrical relay business.

Not only did Elgin improve the performance of standard relays but they completed a design which was dormant because of its small size and produced a miniature relay so small that it could only be best manufactured in their watch factory.

Its possibilities are great and except that they designed it in a partial vacuum as regards specific needs it is a real contribution to miniaturization. The potential uses of these devices are very great. The difficulty is that the services know they have a great need for this type of development in the relay field and that they did not seek out a source for it and promote its creation. Watch companies are naturally the place to turn for this effort.

3. A third case in point is the manufacture of reading and writing heads for use in computers.

These are small electrical devices generic to computers. They record and pick up the electrical impulses upon which the computer is dependent for its function. They are, as illustrated by the Hughes Aircraft sample, about three-fourths by one-half by one-fourth inch in dimension and contain several extremely small parts. They are a natural product for a watch plant. Watch plants contain all the equipment necessary to make them. The skills required are inherent in watch manufacture. Further, watch plants are already organizations in being, functioning properly in the coordination of production, engineering, tooling, machinery and equipment, and trained skilled workers.

To allow new facilities to be built and the consequent disruption and uprooting of personnel to man them, taken from already functioning organizations, is wasteful of the national assets. If such waste of the Nation's assets is essential to the defense of the country, then no present functioning industry is essential to its defense. A study of this small assembly wherein the watch industry can prevent waste is enough in itself to prove essentiality. If this not be true, then carried to its logical conclusion the country can only be defended by devouring itself, and in that event you have nothing left to defend.

4. The fourth and most impressive illustration of the essentiality of the watch industry is the chronology of the "10 to the third gyro" developed at the instrumentation laboratory of the Massachusetts Institute of Technology.

The "10 to the third gyro" is a miniature gyro of broad application in the control of missiles, planes, etc. It was first presented in prototype form on March 24, 1954, to a meeting of possible producers as a classified item.

On January 15, 1955, it was publicly presented by an organization claiming productive capability and declassified. On January 25, 1955, the laboratory ordered one which was promised for delivery April 15, 1955. It was received November 7, 1955, tested by the laboratory, found unsatisfactory, and returned to the producer on February 20, 1956. No effort has been made to supply the laboratory with a satisfactory gyro since that time, of which the laboratory is aware.

On June 9, 1955, the Bulova Watch Co. was given a contract with no compensation to make production studies of tooling and manufacture, which contract was completed April 25, 1956. On January 15, 1957, bids were requested from possible suppliers, which bids were submitted and evaluation of them started. On April 15, 1957, the procurement requests were canceled.

The laboratory knows of no satisfactory "10 to the third gyro" presently available.

If this gyro had been given to a watch company in 1954 when it was first presented for manufacture, it would be in full mass production today. All the evidence confirms the essentiality of the watch industry for this component, a component highly essential to control of planes and missiles—one which represented a major substantial advancement of the art. This component is still 1 to 2 years away from tooling and production. That this could happen is amazing and horrifying. It brings into sharp relief the folly of building new facilities, assembling new organizations to produce for American defense, and allowing the destruction of organizations of great skill and experience already in being. Certainly the study of the watch industry in relation to defense brings you inescapably to the conclusion that it is essential and should be preserved.

Supplemental Statement of George G. Ensign

On February 1, 1963, Elgin National Watch Co. was awarded a contract to develop and build the miniature electronic central timing equipment for the manned spacecraft Apollo. On December 13, 1963, another contract was awarded to Elgin for a comparable but one-fifth-sized version of this system to be carried in the lunar excursion module associated with this same program to take man to the moon. Elgin was selected to do these tasks over competing proposals from many of the most qualified companies in the electronic field, primarily on the basis of our intimate knowledge of how to measure time precisely and reliably and the incomparable skill possessed by the watch industry in the field of miniaturization.

Our industry's ability to measure time accurately and reliably is, I believe, accepted by you gentlemen without question; but I wonder if you have a clear concept of what we really mean by precision miniaturization.

First, I would like to show you some highly precise instrument parts manufactured by Elgin some years ago and used in its marine chronometer for the Navy. I use these parts to illustrate precision and not miniaturization. I am sure that there is a limited number of instrument model shops and extremely precise toolrooms in this country that can make a few of these parts. I am equally sure that there is not a company in the United States other than Elgin, Bulova, and Hamilton who, given dimensionally perfect parts for the chronometer, would be capable of so adjusting these instruments that they could meet the extremely rigid timing specifications required of this master navigation instrument. Nor is there a company in the country aside from those just named that has the know-how and equipment to manufacture these parts on a quantity production basis.

And now to add miniaturization to precision. May I now show you the assembled movement of an Elgin ladies wristwatch. This tiny instrument contains 108 individual piece parts, each of which is made to as high a degree of precison as are the parts for the larger chronometer. Scarcely any of the parts in this watch can be manufactured completely on machines or tools that are not peculiar to the horological industry. Further, their design and production requires the application of the highest order of those skills unique to fine watch manufacturing.

In order that you may visualize the degree of miniaturization of these precision parts more clearly, I would like to give each member of the committee a small plastic disk in which a few watch parts have been mounted. Along with each disk $ give you a jeweler's eye loupe with which to examine them. To the naked eye a part such as the tiny gold screw in the exhibit would appear only as an unidentifiable metal particle. The smallest screws found in a fine jeweled watch are but twenty-six thousandths of an inch long, weigh thirteen millionths of an ounce, and contain over 300 threads to an inch. Their dimensions are accurate to within plus or minus one ten-thousandth of an inch. They are so small that 60,000 of them—each perfectly threaded and slotted—can fit inside a thimble. One of the gears (the fourth gear) found in a conventional watch is but 0.154 inch in diameter and has 54 teeth, each a miniscule 0.009 inch long. A typical hairspring is made of a tiny ribbon of metal only three and one-half thousands of an inch wide and three-quarters of a thousandth of an inch thick. While called a "hairspring," it actually takes a stack of five to equal the thickness of a human hair. Pivot diameters on watch pinions are frequently as small as twenty-eight ten-thousandths of an inch. The tools and dies used in making parts such as these, of course, must be fantastically precise.

I am also submitting for the committee's examination the train and indicating dial of a miniature elapsed time indicator of a type manufactured by Elgin for the military and also an extremely small digital readout elapsed time indicator of a design that Elgin has recently placed in production. You will note that the tiny gears, pinions, and other parts used in this instrument are comparable both in quality, precision, and size to the parts used in a commercial wristwatch.

Along with this exhibit I would like to show you the electric motor (400 cycles synchronous) which powers this mechanism. It measures less than three-eighths inch in diameter by about one-fourth inch long. Insofar as I know, this is the smallest electric motor presently manufactured for any practical application.

Elapsed time indicators are rapidly becoming an essential instrument to monitor the accumulation of service hours to which certain devices have been subjected. In this manner periodic inspections, maintenance, and replacements can be programed to insure that critical devices and components can be utilized at maximum reliability. Many, many thousands of Elgin's elapsed time indicators are monitoring such systems as radar, radar counter measures, radio, gyroscopes, and navigational. Typical applications are in connection with the following: the Atlas, Minuteman, Titan 1–223, Pershing, Bomarc, Sergeant, and Skybolt missiles; the B–52, B–58, and B–70 bombers; the F–105, F–106, F–110, and F–111 (TFX) fighter planes; and the Gemini, Apollo, and LEM spacecrafts.

These miniature mechanisms are only the first of an entirely new field of instrumentation that you will soon see come into prominence in a myriad of areas in science, space, and industry if the miniaturization engineers' skills are kept intact.

I would now like to show the committee how the horological industry applies its unique skills in fields normally considered to be outside our areas of specialization, namely electronics. Let us now return to Apollo and LEM. I mentioned in my introductory remarks that Elgin had been awarded contracts to develop, design and build the central timing equipment required for these programs over competing proposals from many of the most highly qualified companies in the electronic field. Let's examine why.

A few years ago, in the days of vacuum tubes, engineers would have been hard pressed to package a system embodying the functions, characteristics, and reliability now exhibited by these spacecraft systems in a cabinet perhaps 20 or 25 feet long, 6 feet high, and 3 feet deep. With the advent of transistors and other solid state components, such a system could have been miniaturized to a package about the size of a three- or four-drawer filing cabinet. The maximum space and weight available in Apollo, however, allows only a volume about like a loaf of bread and a weight of 10 pounds.

It is true that without the marvelous developments that the electronic industry has produced in integrated circuit micromodules this would not have been possible. However, the requirement to assemble these modules together and package them densely is so very new that it was only natural that the space programs should look to a watch company to physically handle and assemble them into a compact, reliable, lightweight system.

The Apollo unit contains about 5,000 individual components assembled to the associated circuits by over 15,000 extremely precise and uniform micro spot welds. It measures time with an accuracy of 3 seconds per year and a failure rate of 1 in 14,300,000 space flights.

May I now show you a partially assembled Apollo circuit board illustrating miniature circuit welding techniques. When Elgin started working on these programs, we found it was necessary to apply our best skills first to create micromanipulators to assist us in holding and positioning these tiny parts. We found also that even the most advanced microwelding equipment commercially available left much to be desired, but again, by applying watchmaking microwelding techniques we were able to advance this state of the art appreciably. For example, circuit welds of almost hair-size wires and metal strips had to be produced so consistently and reliably and without rejects that we found it necessary to develop a monitoring device which measures all of the variables involved in producing a good weld after the parts were in place, then determines that the conditions necessary to create a good weld are present before the welding current is applied. Further, immediately after welding, and before the electrodes are removed from position, it measures the electrical characteristic of that welded part of the electric circuit to determine that a good weld has been produced. Once a weld tool is removed from work, it becomes almost impossible to measure these characteristics so that one may be certain that the circuit will function reliably.

The LEM unit is in most respects comparable to the Apollo but slightly less complex in certain functions. Having already had a number of months' experience in design and fabrication in such systems, Elgin was able to miniaturize further this system into a package only one-fifth the weight of Apollo and occupying a proportionately smaller volume. To make these results possible, some of our most experienced research men, thoroughly indoctrinated in the techniques of precision miniaturization, were transferred from our watch research and development group to our space program. It was through their efforts and their efforts alone that these accomplishments were possible.

May I raise the question of where men such as these will come from in the future in the event that our industry is permitted to wither away. May I assure you that even in our industry it is becoming more and more difficult to find talent to staff such programs? Ten years ago Elgin employed 50 to 60 scientists, engineers, and supporting technicians in its watch development laboratory plus additional assistance from sponsored projects in outside facilities at Armour Research Foundation, Chicago, Ill., Battelle Memorial Institute in Columbus, Ohio, and Mellon Institute of Industrial Research in Pittsburgh, Pa. The economic condition of the watch industry has so deteriorated that such an effort can no longer be supported. Today we can count but five men in our watch laboratory and no one is being utilized on a sponsored basis. Our technical value to American science, industry, and our military strength is rapidly approaching the point of no return.

HAMILTON WATCH Co.,
Lancaster, Pa., August 21, 1964.

Senator STUART SYMINGTON,
Chairman, Special Subcommittee of Senate Armed Services Committee, Old Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: In the course of my testimony before the subcommittee, I adverted to the recent finding of the Federal District Court in New York that the Swiss watch cartel had been engaging in various activities designed to cripple the U.S. watch industry in violation of our antitrust laws. Because of the chairman's apparent interest in that decision and Senator Jackson's expressed concern for preserving competition—particularly in areas of actual or potential military importance—a full description of that suit is in order.

There is, at the outset, a fundamental difference in the nature of the Swiss and United States industries. Unlike the three remaining domestic U.S. jeweled watch producers, all of whom are fully integrated watch manufacturers, competing intensely with one another as well as the Swiss, the Swiss watch industry is organized and tightly controlled along craft lines. Out of the huge Swiss industry, there are no Swiss companies which are watch manufacturers in the sense that Hamilton, Elgin, and Bulova are in their U.S. operations. Only a relatively few watch manufacturers in Switzerland produce their own watch parts and none of these companies manufacture all of their own watch parts requirements. Gruen, Benrus, Longines, and the other firms popularly associated with Swiss watches are companies engaged basically in the assembly into watch movement of watch parts, frequently obtained from common suppliers, and in the importation of watches or watch movements into this country.

Parts manufacturers in Switzerland are bound together in an association known as UBAH, named as a coconspirator in the cartel suit. Swiss firms engaged in the manufacture of rough movements are owned or controlled by a holding company known as Ebauches, S. A., a defendent in the antitrust suit. The assemblers are, almost without exception, members of defendant, FH. At the top of this tightly knit hierarchy are:

(*a*) "ASUAG" or "Superholding" (also named as a coconspirator), the stock in which is owned by the Swiss Government (37½ percent), a group of Swiss banks (34¼ percent), FH (10 percent), Ebauches (2½ percent), and others. ASUAG, in turn, owns a majority of the stock of Ebauches. Its purpose is to control the level of production of the Swiss watch industry.

(*b*) The Swiss Watch Chamber, membership in which consists of 16 watch industry organizations, including FH, Ebauches, UBAH, and ASUAG. The watch chamber acts as liaison between the watch industry and the Swiss Government and, by law, advises the latter on such industry matters as export permits for watches and watch movements.

In short, the domestic producers do not severally compete so much against separate importers such as Benrus, Omega, and the other importers as they do against the monolithic Swiss watch industry. The importers exist at the sufferance of that industry, all elements of which are bound together in an agreement known as the collective convention. The latter imposes upon its signatories stringent restrictions on manufacture outside Switzerland, on furnishing technical or financial aid to manufacturers outside Switzerland, on the sale and export of watch parts for manufacturing purposes, on the importation of watch parts into Switzerland, on the importation of watches and parts into this country from countries other than Switzerland, etc.

The Government's antitrust complaint, filed in New York almost 10 years ago, charged a broad combination and conspiracy to restrict, discourage, and eliminate the manufacture of watches and watch parts in this country and to restrain U.S. imports and exports of these commodities—in violation of the Sherman and Wilson Tariff Acts. Named as defendants along with FH and Ebauches were their jontly owned U.S. Information Center subsidiary, some 19 watch importers including such well-known companies as Bulova, Benrus, Gruen and Longines, and the importers' U.S. trade association, the American Watch Association, on whose behalf Mr. Lazrus testified at these hearings. Bulova, while a defendant, had been outspokenly critical of the cartel.

Commenting on the suit at the time it was filed, the Attorney General said:

"This complaint attacks restrictive controls upon the American jeweled watch industry which have retarded the growth of the industry and weakened its competitive position. It is imperative that our domestic watch industry be free from practices which curtail domestic production and restrict the importation and exportation of watches."

Eleven of the importers and their trade association entered into consent decrees with the Government in March 1960. The remaining importers, the two Swiss trade associations and their U.S. subsidiary chose to contest the charges. The case, tried between November 1960 and May 1961, produced over 8,000 pages of transcript. Almost 1,300 exhibits were received in evidence.

Judge Cashin's opinion, rendered on December 20, 1962, occupies 115 printed pages. His findings of facts alone are contained in 247 separately numbered paragraphs. From these detailed findings, he concludes that as early as 1931 the defendants "entered into a combination and conspiracy to eliminate competition in the U.S. manufacture, import, export and sale of watches, watch parts, and watchmaking machinery"; that pursuant to this conspiracy, defendants from time to time entered into certain agreements "in order to prevent the development and growth of competitive watch industries in countries other than Switzerland, and particularly in the United States"; and that many of the practices engaged in by defendants (frequently with the active assistance and encouragement of the Swiss Government) were "intended by defendants to and did impose unreasonable restrictions on the manufacture of watches and watch parts in the United States."

Typical of such practices were Swiss prohibitions on the export of watchmaking machinery to this country, their imposition of quantity limits on the number of watches Bulova would be "permitted" to produce in its U.S. plant, their refusal to export watch parts except for repair purposes, their threatening of sanctions against and blacklisting of American firms, their causing Benrus to liquidate in such a way that it could no longer be used in the manufacture of watches the plant of the Waterbury Watch Co. which Benrus acquired in 1938, their limiting Gruen in the number and type of watches it could produce in this country and in the number of parts it could import for this production from Switzerland, their "consent" to Bulova's operation of a government jewel-bearing plant in North Dakota so long as the jewels were sold for use in instruments and not in jeweled watches; their refusal to permit Elgin to export to Switzerland (for inclusion in movements being made there for Elgin) unbreakable mainsprings Elgin had developed from a special alloy unless Elgin would agree not to advertise the fact that its watches contained unbreakable mainsprings, etc.

These are but illustrative. Together, the vast network of agreements and the catalog of practices Judge Cashin found to exist present a classic description of a full-blown cartel in full-scale operation. He refused to accept defendants' argument that the various restrictions were not directed at the U.S. watch industry. "The U.S. watch industry," he concluded, "was the Swiss watch industry's biggest competitor, and the restrictions of the [cartel agreements] have obviously had a crippling effect in this country and were so intended."

Final judgment was entered in January of this year and defendants have appealed to the Supreme Court. While that judgment attempts to check and present some of the more flagrant restraints of which the Swiss industry has been guilty in the past, it does not and could not alter in any way the structure of the Swiss industry. If the domestic producers are forced from the scene, the nature and extent of competition remaining within the United States would be determined by the cartel.

The Swiss, with over 70 percent of the U.S. market today, are bent upon a course of total monopolization. As an industry, they have and exercise the power to determine production quotas in Switzerland, to grant and condition export licenses, to fix export prices. They have the power to raise or lower those prices and to exclude competition. They have repeatedly manifested a purpose to eliminate competition and to monopolize the U.S. watch market, and their present effort to remove the existing protection for U.S. manufacturers is but the latest in a long series of attempts calculated to produce that result. If they succeed in this current effort, the recent decree of the court will be frustrated and the Government's 10 years of litigation will have been for naught. More important, the country will have lost an industry that has helped keep watch prices down; provided a competitive technological spur, and contributed importantly, through development and production of timing and other miniature devices for the military to the national defense.

Very truly yours,

ARTHUR B. SINKLER, *President*.

APPENDIX III

INFORMATIONAL MATERIAL

[COMMITTEE PRINT]

ESSENTIALITY OF THE AMERICAN WATCH AND CLOCK INDUSTRY

REPORT

OF

PREPAREDNESS SUBCOMMITTEE NO. 6

OF THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

UNDER AUTHORITY OF

S. Res. 86

(83d Congress)

Printed for the use of the Committee on Armed Services

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PREPAREDNESS SUBCOMMITTEE NO. 6—ESSENTIALITY OF THE AMERICAN WATCH AND CLOCK INDUSTRY

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LETTER OF SUBMITTAL

UNITED STATES SENATE,
COMMITTEE ON ARMED SERVICES,
July 23, 1954.

Hon. LEVERETT SALTONSTALL,
Chairman, Senate Committee on Armed Services,
Washington, D. C.

DEAR SENATOR SALTONSTALL: It is my honor to transmit herewith the report of Preparedness Subcommittee No. 6, which you appointed on May 22 to study the essentiality of the American horological industry to our Nation's security.

With the submission of this report, and in the absence of any contrary directive from you, the subcommittee considers itself discharged.

Sincerely yours,

JAMES H. DUFF,
Chairman, Preparedness Subcommittee No. 6.

ESSENTIALITY OF THE AMERICAN WATCH AND CLOCK INDUSTRY

On May 22, 1954, Senator Leverett Saltonstall, chairman of the Senate Committee on Armed Services, established Preparedness Subcommittee No. 6 to study the essentiality of the American horological industry to national defense.

The subcommittee, directing its attention solely to the question of defense essentiality, held hearings on June 30, July 1 and 2, 1954. The subcommittee received evidence to the effect that—

> The watch and clock industry has a unique pool of skilled workers, some of whom require up to 10 years of training and experience before they achieve professional proficiency in their precision crafts;
>
> The Nation has historically called upon this skilled pool of workers from the watch and clock industry in time of war as its primary source of precision timepieces, military precision timing devices, and for the development and production of other essential miniature instruments;
>
> In times of emergency, the Nation cannot safely rely on foreign precision timepieces, other precision timing devices, and jewel bearings needed for defense requirements;
>
> Unless the training and employment of this skilled pool of workers in the horological industry are continued, the pool of workers cannot be maintained intact. Their unique proficiencies and skills would deteriorate in industries requiring less highly developed skills and the particular skills required in time of war emergency would not be available.

An abundance of expert testimony was heard by the subcommittee. The testimony was in almost unanimous agreement that the pool of skilled workers of the American watch and clock industry is essential to the security of our country in time of war.

As stated above, the subcommittee has confined its study and confines its report to the precise question propounded by its charter—the essentiality of the industry to national defense.

On all the evidence, the subcommittee concludes:

1. Although the Nation was substantially self-sufficient in the production of precision instruments required for defense in World War II, it must be remembered that the Nation had over 2 years to prepare for war.

2. A future war may come swiftly and without advance notice. In such an event, there will be no time to provide training in the highly specialized and critical skills needed to produce the precision timing devices for defense requirements.

3. The highly skilled workers in the American watch and clock industry, who require long years of training and experience, and their unique ability to develop and produce, within the shortest time possible, precision instruments to minute tolerances, are essential to the national defense. Therefore, it is in the interest of national defense to keep this essential industry alive and vital.

84TH CONGRESS } SENATE { DOCUMENT
1st Session } { No. 49

ESSENTIALITY OF THE AMERICAN HOROLOGICAL INDUSTRY

STAFF STUDY

OF

PREPAREDNESS SUBCOMMITTEE NO. 6

OF THE

SENATE ARMED SERVICES COMMITTEE

UNDER AUTHORITY OF

S. Res. 185

OF THE

EIGHTY-THIRD CONGRESS

PRESENTED BY MR. DUFF

JUNE 8, 1955.—Ordered to be printed

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ESSENTIALITY OF THE AMERICAN HOROLOGICAL INDUSTRY

INTRODUCTION

On May 22, 1954, Senator Leverett Saltonstall, chairman of the Senate Committee on Armed Services, established this subcommittee to study the essentiality to the Nation's defense of the domestic watch and clock industry. This subcommittee is one of the Preparedness Subcommittees of the Senate Committee on Armed Services. In conducting this investigation we have endeavored to stay within the limits of our charter and to direct our attention to the importance of the products and skills of this industry to the "preparedness" of the United States.

It is elementary that in time of war all things are essential. We have received testimony to the effect that in past wars such things as horse chestnuts and peach kernels were found to be essential. Here we are dealing with a somewhat different problem. We are considering the skills that have transformed an ancient art into a modern craft which, while using mass-production techniques, has retained its unique ability to work in microscopic dimensions and tolerances. We must not only consider the known products of the watch and clockmakers but we must also take into account the yet unimagined developments which only their trained hands and eyes can produce.

Our task has been made easier since all of the witnesses appearing before our committee at hearings held on June 30 and July 1 and 2, 1954, agreed that the horological industry was essential to the Nation's defense. The only demurring voice objected not to the fact of essentiality but to the degree of essentiality. If then we start with the premise that the skills of this craft are essential, it becomes our duty to determine whether they are essential in peacetime and how essential they will be in the event of a future emergency. We will therefore confine ourselves to the degree of importance of these skills, and to consider how important it is for this Nation to keep its watch and clockmakers "in training" for a fight which international communism may force upon us.

One could not examine the facts at close hand, as we have, without being thoroughly impressed that watch and clock making involves the observance of such tolerances on such microscopic work as almost to defy imagination. Training people to work with miscroscopic parts to such accuracy and to fabricate tools which will respect the subminiature measurements, requires periods of apprenticeship seldom heard of in other branches of American industry. In the case of tool and die makers, for example, it requires up to 10 years to attain proficiency in their work. It is apparent that if we need these skills in time of war we must not wait until then to develop them. War, if it should come again, will come without warning. We shall have no opportunity to build up a defense organization as we have been fortunate enough to do in the past. We must be prepared.

THE HISTORICAL IMPORTANCE OF THE WATCH AND CLOCK INDUSTRY TO NATIONAL DEFENSE

To understand the degree of importance of this industry we should first look back at its history. World War I gave evidence that the United States was not able to rely on foreign sources and there was an acute shortage of timepieces and timing devices. Those whose regular business depended on the importation of watches and watch movements found they had to turn to other pursuits while the sources were shut off.

Prior to World War II, Hitler set about to destroy the horological industry of England by subsidizing the German industry and flooding the English market, driving the watch and clock manufacturers of that great country to the wall. As a result of this maneuver the British industry was neutralized and at the beginning of World War II Great Britain had to turn to the United States for help. She remained dependent on foreign imports throughout World War II.

We call to the attention of all the words of Sir Stafford Cripps, to the House of Commons in 1945, when he explained this unfortunate episode in British history:

> * * * when the war came and we needed, naturally, to mobilize all the engineering resources we could muster, the inadequacy of the clock and watch industry left a very serious gap in what may be termed our industrial armor. The services required a great number of clockwork fuses, as well as clocks and watches.
>
> * * * * * * *
>
> If we had had a considerable watch and clock industry earlier, not only should we have avoided the risks which are inseparable in such circumstances from dependence on overseas sources, but we should have had a reservoir from which we should have drawn machine tools, skilled labor and management well suited to the manufacture of many of these precision instruments upon which war so much depends today.

Certainly no Member of the Congress of the United States would want to be called upon to explain why an industry vital to the Nation's defense was not preserved.

All of the warning signs have been raised indicating that the domestic watch and clock industry is in a dangerous situation which, if permitted to continue unchecked, would result in the atrophy of skills which we are told we will desperately need in the future as we have in the past. If anything, we are today more dependent on the accuracy of timepieces than we have ever been in our Nation's history. The speeds of planes, ships, trains, and automobiles are ever increasing. Accurate timing and controlling devices will be needed in the future as much if not more than in the past.

During World War II the American watch and clock industry was completely converted to defense production. In addition to the traditional horological instruments which it manufactured for the defense effort, such as chronometers, chronographs, navigation watches, and military timepieces of every description, it also produced unbelievable quantities of time fuses for antiaircraft and artillery shells, timing mechanisms for land and sea mines, altimeters, and a host of other precision instruments for ships, tanks, and aircraft.

The dependence which the United States had on its horological industry in World War II parallels that of any nation which is involved in modern warfare. With the outbreak of hostilities in Korea, our Defense Establishment again looked to the American watch and clock industry to satisfy our urgent demand for large quantities of precision instruments of high quality in the shortest possible time. Again, the horological industry produced.

It has been suggested that the defeat of Japan resulted, in no small degree, from its lack of an effective horological industry. The fact that the Allied forces selected the site of the German jeweled watch industry as a target of prime strategic importance underlines the respect which our own military leaders have for the industry as an indispensable part of a nation's industrial strength.

The experience of the British in finding that "the inadequacy of (their) clock and watch industry left a very serious gap in what may be termed (their) industrial armor" reinforces this opinion.

We must not fail to take advantage of the awful experience of our English friends during World War II. This country cannot depend on an overseas supplier of critical defense materiel. To do so would indeed make us most vulnerable. Were the supply lines from Switzerland closed to us in a period of emergency, we could look to no one else in the family of free nations, as the British were able to look to us in World War II.

We could do no greater service to international Communism than by depriving ourselves of industries such as our domestic horological industry.

THE INDUSTRY—ITS COMPONENTS

The American horological industry consists of four distinct components:

1. Jeweled-watch manufacturers.
2. Pin-lever manufacturers.
3. Clock manufacturers.
4. Manufacturers of component timers.

Necessarily, the greatest degree of precision is required in the manufacture of watch movements. Jeweled watches differ from nonjeweled watches primarily in the use of jewel bearings in the escape mechanism while pin-lever watches use hardened steel pins and bearings. Essentially, the skills necessary to effective production in either segment of the industry are similar, although because of the greater miniaturization and greater use of manual skills in the jeweled-watch industry some techniques indispensable to the manufacture of jeweled watches are not found in the pin-lever watch industry.

Extraordinary tolerances must be respected in the manufacture of clocks and component timers as well, although to a lesser degree than in the manufacture of watch movements. The precision which must be achieved on a mass-production basis even in the manufacture of clocks and other timers, however, is far greater than that required from nonhorological industries.

To demonstrate the difficulties which we would face in establishing a jeweled-watch industry if none were available to us, we may examine the slow, tedious development of the American jeweled-watch manufacturing capability of the Bulova Watch Co. In 1930 Bulova embarked upon a program to manufacture jeweled-watch movements in this country. The Swiss industry at the time permitted Bulova to bring to the United States tools, dies, drawings, and machines. In spite of this cooperation, it was not until shortly after World War II that Bulova was able to manufacture, domestically, all the parts that go into watch movements. Today, even such an accomplishment as this would be impossible due to the fact that since 1934 the Swiss, with an understandable desire to preserve their own industry, have forbidden the export of equipment needed to establish a watchmaking industry.

We cannot overemphasize the long periods required to train key horological personnel, although production people, which constitute approximately 75 percent of the labor forces of the jeweled-watch industry may be trained in from 6 to 12 months. The artisans and supervisory personnel who form the backbone of the industry must have up to 10 years of experience before they are proficient in their skills.

THE INDUSTRY—ITS CAPABILITIES AND UNIQUENESS

It is perhaps improper to classify watchmaking as an industry. Because of the myriad of delicate skills that are involved, it may be best spoken of as craft which designs, engineers, tools, and mass-produces the smallest self-powered machine which man has devised—a machine that combines unparalleled precision and accuracy in dimensions so small that other industries could not possibly match it especially on a mass-production basis.

In peacetime, the industry produces timepieces of all kinds—clocks, watches, as well as scientific timing devices and controls. In time of national emergency the industry has served as an arsenal of sensitive, delicate precision devices needed by the armed services in enormous volume. With rapidly advancing technological developments and with the increasing trend toward more precision, greater miniaturization and increased automation, the skills and facilities of this industry will become increasingly important and vital to the national welfare.

Generations of research, development, and production have produced know-how and skills peculiar to the horological industry. Horology has become a unique science requiring specially trained and highly skilled personnel in engineering, toolmaking, poising, and other technical aspects of design and production. It has no counterpart in modern industry. This background, coupled with a capacity for volume manufacturing, permits the watch and clock maker to convert to precision manufacturing for defense almost immediately when time is of the essence.

Because of their special abilities, watch and clock makers have undertaken numerous research, development, and design problems in the interest of national defense, which have been successfully solved for the military. As Secretary of Defense Charles E. Wilson has indicated, no one can predict what new and yet-undreamed-of military items horologists may be called upon to produce in the future.

Apart from their unique capabilities, the nature of the watchmakers' skills distinguishes them from other manufacturers. The extraordinary dexterity and the almost unbelievable accuracy required of watchmakers will soon be lost unless the skills are exercised on a continual basis. Thus, the "mothballing" approach can have no application to watchmaking. The skills, which deteriorate with disuse, cannot be stockpiled. They can be preserved only in a going industry.

If the industry loses a skilled worker because of the economic difficulties which his employer may experience, he is reluctant to return to his craft because of the fact that he has not only lost confidence in watchmaking as a secure employment, but also gained seniority in another industry which he is unwilling to sacrifice. Even if he does choose to return to his craft, extensive retraining is necessary—up to 3 years in some instances—in order for him to regain the skill needed to work with efficiency on vital microscopic tolerances. Thus, it is apparent that if we are to have a horological industry available to us in time of war, which can rapidly expand and achieve production in high volume, it is absolutely necessary that we have a healthy peacetime base. It must not be forgotten that in peacetime watchmakers have performed and will continue to perform research and development which may result in new precision devices which will greatly increase our defense strength.

THE INDUSTRY—ITS CONDITION

During World War II the American watch- and clock-making industry converted its production 100 percent to defense work. During this period, in which it was producing no clocks or watches for civilian consumption, the industry lost its domestic commercial market to the American importers of Swiss watch movements. Upon the cessation of hostilities in 1946, the industry naturally found it necessary to convert to civilian production, but found it almost impossible to compete with the Swiss. Reconversion was difficult and it was almost 3 years before the domestic industry regained efficient mass production. By this time the importers' hold on the market was strong, and at the present time but 15 percent of the jeweled watches, for example, sold in this country are domestically manufactured. This is the price that the American horological industry has paid for its complete contribution to the national defense during World War II.

We are not here primarily concerned with the financial condition of the domestic industry or any of its components. We have been advised that any of the American companies now manufacturing clock and watch movements, which are unable to make money in doing so, can, and in some cases will, either diversify their operations and make other products, or become, themselves, importers of foreign-made movements which can be cased and merchandised in this country under the long-respected American names.

We are concerned, however, with the continued existence of a healthy horological industry in which the vital skills which we have discussed may be retained, and to which new people will be attracted to learn the ancient watchmaking techniques. Without a continually replenished reservoir of skilled craftsmen, the industry will perish.

Although the economic health of the several components of the industry may be maintained by diversification or by importing, it is clear that only through the continuous manufacture of horological movements can the indispensable labor force be preserved. It thus follows that, even though the industry were engaged entirely in the manufacture of certain devices for the military, which do not require the precision or accuracy that watch movements require, the labor reserve would soon deteriorate and hence be unavailable, at a time of need, to manufacture those precision devices which this industry alone can produce.

Domestic employment in the manufacture of jeweled movements has declined from 8,151 workers in 1951 to 4,300 at the present time.

If this trend continues, it is obvious that the country will soon lose its domestic jeweled-watch industry. In the opinion of the subcommittee, such a loss would be catastrophic.

MILITARY ESSENTIALITY

In seeking an answer as to the degree of essentiality of the horological industry to warwork, Senator John C. Stennis inquired as to whether there were other manufacturers who could produce similar war items such as fuses. Witnesses representing both the Government and the industry pointed out that there were other companies who could make these items provided they were given machinery, time, know-how, and money. At the present time, moreover, there are only 3 companies outside the horological industry producing fuses whereas there were at least 10 or more producing them during the Second World War. Approximately 80 percent of the production in 1953 came from the horological industry.

The story of how peak production of fuses was reached during World War II is found in the statement made to this subcommittee by Mr. Roy T. Hurley, Chairman of the World War II Fuse Integrating Committee, set up as a clearinghouse for the entire fuse program. It permitted intensive specialization by different members of the industry.

It was estimated that the E. Ingraham Co., for example, could produce 10,000 fuses a day. This was inadequate, however, to meet the need. Therefore, this plant concentrated on manufacturing some of the most critical and difficult parts of the fuse because its watchmaking skills and facilities permitted such specialization. With this procedure, 66,000 sets of parts a day were soon rolling off the production line and being shipped for assembly to the Eclipse Division of Bendix Aviation, Eastman Kodak Co., National Cash Register Co., King-Seely Corp., Thomas A. Edison, Inc., Borg Products Division of the George E. Borg Corp., Elgin National Watch Co., Hamilton Watch Co., Waterbury Clock Co. (now United States Time Corp.), and Frankford Arsenal.

The other members of the horological industry also supplied other parts and the nonmembers were able to assemble tremendous quantities of fuses.

Another example of how the horological industry responded to the needs of the military can be cited in the experience of the Hamilton Illinois Watch Co. Prior to World War II, chronometers for ships were handmade and came from Switzerland or England. The Navy could acquire but very few from these sources, so turned to Hamilton Watch Co. with a request that large volume production of this highly complicated mechanism be initiated. From the model supplied by the Navy of a foreign chronometer, the company set up a production line which supplied the Navy on a high-volume-production basis approximately 10,000 chronometers by the end of the war. The company was commended by the Navy in 1945 for its achievement:

> Your company has done a magnificent and unprecedented job on the marine chronometer. The instrument today is superior to the world's finest, which latter took many years to evolve.

The horological industry supplied 3½ billion parts and tools to manufacturers outside its industry during World War II and furnished the military with 25 million completed end items. Although there are many manufacturers in this country who can produce fuses and other precision materiel, given the time, equipment, know-how, and money, their own specialties will be urgently needed by the Government in wartime. The Nation will again look to the watch and clock industry as its immediate and primary source of precision devices.

The record is replete with many, many instances of the military services calling upon the horological industry with urgent requests for production of vital precision devices and instruments which were so badly needed to win a war. Had not the skills of this industry been available our ability to have won World War II would have been seriously impaired. A dissipation and loss of these same skills by allowing this industry to deteriorate would be a blow to national defense in another emergency.

Past experience shows that sound planning for mobilization requires the maintenance of a healthy watch and clock industry. We must not disregard this experience.

MILITARY RESEARCH AND DEVELOPMENT

One of the most important contributions of the horological industry to national defense has been in the research and development work which it has accomplished. There are countless jobs which have been done, but an example of one will suffice for illustrative purposes.

The powder-type fuse used in World War I was found to be unsatisfactory and Army Ordnance, in 1929, decided to procure the drawings and technical know how of a new antiaircraft fuse which had been developed by the Junghans Clock Co. of Schramberg, Germany. The Swiss watchmakers were producing it at this time on an experimental basis for the British Government. A facility at Frankford Arsenal was set up with machinery from Junghans to manufacture this new-type mechanical time fuse. Several German and Swiss horological engineers were hired to run the plant. It took 8 years to produce a sample lot of fuses. During this period the arsenal consulted with and called upon the American horological industry to assist them in overcoming the timing, testing, and production problems.

Shortly after 1938, the job of production was given to the horological industry and the fuse was substantially redesigned and improved in order to increase volume production and to save strategic material. When World War II came, and it was necessary to establish sources for the manufacture of this fuse, other companies were brought into the program. But in order to get them into production satisfactorily, the horological industry had to make hundreds of engineering changes and supply many of the critical parts as well.

Research and development contributions have been made and are currently being made by this industry on the numerous critical military programs: Improvement and standardization of mechanical time fuses; development of electromechanical and electrical time fuses; fuse miniaturization; development of low-temperature lubricants for precision mechanisms; development of timing release mechanisms for instrument parachutes; development of production methods for piezo-electric quartz crystals; development of gear-autosyn units for converter and radio magnetic indicators; research on mass production of jewel bearings and development of domestic sources of jewel bearings; research on aerial cameras; development of new types of timepieces, such as break circuit chronometers, memory chronographs, and underwater watches for Frogmen; redesign and improvement of aircraft clocks; and research and development of gyroscopes, safety and arming mechanisms for many types of guided missiles, including both ground-to-air and air-to-air systems.

The industry is uniquely fitted to carry on research and development work for military items. Its components have unusual, integrated organizations, combining the knowledge of theoretical scientists with the skills of precision engineers and craftsmen.

JEWEL BEARINGS

Jewel bearings are tiny synthetic sapphires or rubies. They are used primarily to provide a surface against which the moving parts of various precision instruments can turn with a minimum of wear or friction. Jewel bearings are indispensable in all types of precision instruments as well as in jeweled watches and timing devices. For example, the instruments in a single bomber require more than 5,000 jewel bearings. Unfortunately, there is no satisfactory substitute for them.

The manufacture of jewel bearings requires painstaking training and skill. The shaping and polishing operations must be done to a tolerance of a millionth of an inch. Such production is uniquely within the capability of jeweled-watch manufacturers.

Before 1940, there were virtually no facilities in this country for the production of jewel bearings. We were dependent almost entirely upon imports from abroad. In June 1941 Germany forbade the Swiss to ship any jewel bearings to the United States. In August our Government designated jewel bearings a critical material. Mr. Arde Bulova, chairman of the board of the Bulova Watch Co., had foreseen a possible emergency and in 1940 undertook a program, in which other jeweled-watch manufacturers later participated, to produce these critical items for defense needs.

It is significant that the watch companies not only were requested to make the bulk of needed bearings, but also furnished the necessary machines, know-how, and training for nonwatch producers.

Imported jewel bearings proved to be a most uncertain source of supply, and from November 1942 to March 1943 no bearings were received from Switzerland.

> The production of instrument jewel bearings is a vital factor in our program for increasing aircraft production. As a result, jewel bearings have been designated 1 of the 35 most critical components of military production for which orders must be placed and scheduled through the entire year (War Production Board letter, April 27, 1943).

It was necessary to turn to the domestic jeweled-watch industry to satisfy the critical needs for these jewel bearings.

During World War II, the defense authorities encountered tremendous difficulty in satisfying their requirements for jewel bearings. A jewel-manufacturing industry was started in this country at great cost and with much effort. The industry was abandoned, however, at the conclusion of the war and reliance was once more placed upon Switzerland to supply these vital items.

Since annual imports from Switzerland average over 100 million pieces, the result is that in respect to its requirements for this strategic article the United States remains in an exceedingly vulnerable position because of its dependence on foreign sources of supply.

Following World War II, jewel bearings were stockpiled. However, with the redesign of instruments and measuring devices, these stockpiled jewels became obsolete for the most part and proved to be useless. When Korea began, this country was not able to use them in any great quantity.

As our technology advances, new designs require new types of jeweling. It is necessary to have a capacity for the production of jewels and only the watch companies can supply the talent necessary for the manufacture of jewel bearings.

Shortly after hostilities broke out in Korea, the Joint Chiefs of Staff decided that it was necessary to reestablish domestic facilities for the manufacture of jewel bearings. To accomplish this, the Air Force gave a contract to Elgin Watch Co. for research and development of improved jewel-bearing machinery. In June 1952, Army Ordnance proposals were requested for the construction and operation of a plant to produce bearings at Rolla, N. Dak. Bulova was awarded the contract to build and operate this plant on a dollar-a-year basis. The present capacity of this plant is 5 million a year—far short of the required 150 million a year necessary to supply both military and civilian users in a period of conflict.

CIVILIAN ESSENTIALITY

Frequently overlooked, in the role which an industry plays in time of war, is the contribution it makes to the wartime civilian economy. We take for granted the timepieces by which our hours and days are measured; we fail to appreciate the confusion and inefficiency which would result if we were deprived of these devices.

During the hearings which the subcommittee held, Assistant Secretary of Commerce Lothair Teetor addressed himself to the importance of the horological industry to the civilian economy in time of war. He stated:

> At no time during past wars has sufficient manufacturing capacity for precision timepieces been available in this country to meet both the demands of the military agencies and the needs of essential civilian and war-supporting industries and institutions. * * *
>
> Numerous examples can be cited to indicate the hardships, and frequent production losses, engendered by lack of timing devices. Shortage of precision decimal timers for indutrial use was a chronic problem throughout World War II. Military demand for jeweled timers was so great that few could be released for industrial purposes.

Many defense-supporting industries had an urgent, continuing, but inadequately filled demand for timing devices during World War II. There was a persistent shortage of transportation timepieces, communication timepieces, medical timepieces, industrial timers, and timing devices for mining, research and food processing, to mention but a few essential activities which suffered from a deficiency of timing mechanisms.

Secretary Teetor also pointed out:

> Based on World War II experience, and considering postwar population increase and industrial expansion, it is estimated that in a future emergency a minimum of 3 million jeweled timepieces per year would be needed to meet essential nonmilitary requirements.

Because of the complexity of timekeeping instruments and the changing nature of the demand for them, it is impossible to build a stockpile to satisfy the wartime civilian demand. Clocks and watches are perishable—they require complete overhaul after storage if they are to be accurate.

It is the opinion of the subcommittee that the necessity for timing devices with which the civilian community must operate in an emergency period underscores the conclusion that the American horological industry is essential to our national security.

DEPENDENCE UPON IMPORTS

Secretary Teetor stated before this subcommittee:

> In planning for future mobilization, it would seem questionable to place any reliance whatsoever on a foreign source for precision timepieces.

Switzerland, a nation with which this country has had extraordinarily friendly relations throughout our history, is the world's largest manufacturer of precision timepieces. The Swiss industry, as is our own, is capable of producing not only the timing mechanisms upon which a country would depend in time of war, but also innumerable other precision devices which are necessary to a defense machine. Switzerland's traditional neutrality may be preserved in another world crisis, but a Switzerland surrounded by communism would be of little help to us.

We recognize the importance to the Swiss economy of United States sales of Swiss timepieces. We recognize the great employment which is provided by Americans who import and merchandise Swiss movements. We recognize the difficulty in reconciling these interests with the paramount interest of our national security. We believe, however, that both the Swiss manufacturers and the American importers recognize the overriding necessity of a healthy American horological industry, not only to our own national security but to the safety of the free world in the event of further Communist aggression.

EXPERT OPINION

In the study of any involved and complex subject, the opinions of men who, through training and experience, are expert in the subject are most persuasive. The subcommittee is fortunate in that many people who have been intimately associated with overall mobilization planning have addressed themselves to the problem of the importance of the American horological industry. Without exception, these men have concluded that the industry is vital to the Nation's security in time of war. For example, on November 30, 1948, F. C. Elliot, of the National Security Resources Board, stated that upon the basis of NSRB's study and a review of reports made by the War Production Board, the jeweled-watch industry was one of the four most important in this country, from the standpoint of national defense.

In a 1950 letter to the Senate Committee on Finance, Hubert Howard, then Chairman of the Munitions Board, wrote:

> As I pointed out in my prior letter, the maintenance of a healthy watch industry is essential to the national security. In addition to the items which it alone can produce, the industry undoubtedly would be called upon for the production of other items for which it is not the sole producer. In view of this, it is our feeling that, as a matter of precaution against probable future needs, every effort should

be made to prevent the dissipation of the productive capacity of the industry and to maintain it in a healthy condition.

Early in 1953, an interdepartmental committee established to study the essentiality of the American watch industry found that the production facilities of the industry were both unique and highly essential. It made several subsidiary findings:

1. The industry is dependent upon a very highly skilled group of designing, engineering, tooling, and supervisory workers and some highly skilled production workers.
2. These skills can be acquired only after long training periods.
3. The number of workers in these categories cannot be rapidly expanded in an emergency.
4. The skilled personnel can be retained during peacetime only to the extent that their skills can be profitably used in commercial production of watch movements.

In a letter to the Chief of Naval Materiel, dated March 19, 1954, Adm. M. F. Schoeffel, Chief, Bureau of Ordnance, said:

> While the jeweled-watch industry per se is not the only source of watch- and clock-type movements necessary to the national defense, it is nevertheless considered to be extremely essential in this field in view of its know-how and its ability to make certain essential parts required by the watch and clock industry in general.
>
> * * * * * * *
>
> * * * it is this Bureau's opinion that insufficient capacity already exists in the watch and clock industry, including the jeweled-watch industry, to meet the national defense M-day requirements * * *.
>
> It is therefore recommended that representatives of the Office of Naval Materiel be fully apprised of this situation in order that higher authority may be in possession of all the facts as to the essentiality of the watch and clock industry, no small part of which is known as the jeweled-watch industry.

Roy T. Hurley, president of Curtiss-Wright Corp. and formerly Chairman of the World War II Ordnance Mechanical Time Fuse Integrating Committee, declared:

> * * * I do not believe we would have produced the required quantity and quality of mechanical time fuses if it were not for the American watch and clock manufacturers.
>
> There is no question that their skill and help will be required for national security if we again engage in a major war * * * we must have a strong watch- and clock-manufacturing industry as an essential part of our industry-defense team.
>
> * * * I cannot conceive of this country being dependent upon overseas sources of supply for watches, clocks, jeweled bearings, or precision-time mechanisms in the event of war * * *

Lt. Gen. Levin H. Campbell, Jr., United States Army, retired, Chief of Ordnance during World War II, stated before the Tariff Commission on February 11, 1954:

> * * * I would say having the watch and clock industry as a going industry equipped with the necessary plants, the necessary know-how, the trained people it is of very, very great value to this country as a backlog and a safety for a rapid reaching of production * * *

Dr. Arthur S. Flemming, Director of the Office of Defense Mobilization, said, in testifying before this subcommittee:

> * * * it is an integral part of our defense mobilization base. At the present time, production and employment is below the level that it should be in order to maintain that base in a sound manner.

In speaking of the watch and clock industry as a whole, he said:

> * * * there is no question in my mind at all but that the watch industry as a whole is essential to the national security.

He further stated:

> * * * past experience has indicated that the skills that are present in this particular industry are skills that we can use very effectively in connection with the production of other items.
>
> It is very difficult to train people to the place where they have those particular skills. And I think it is important not only to keep intact, as far as we can, those who now have those skills, but it is also very important for us to have the kind of industry that will attract younger people into it so that they, in turn, will develop those skills. * * *
>
> * * * if we did not have this industry and did not have this industry in a healthy condition, we would be deliberately penalizing ourselves as a Nation as far as the production of fuses and other timing devices are concerned.

Thomas P. Pike, Assistant Secretary of Defense (Supply and Logistics), Department of Defense, testified that—

> All of these (watch and clock) manufacturers are valuable and essential to the Department of Defense * * *
>
> There is no question that the skills involved in these several industries, constituting in its entirety what we call the horological industry, are vitally essential to our national defense in the event of mobilization.
>
> * * * it would be a dangerous thing again from the point of view of national security and defense if any sizable segment of the watch industry or horological industry were to disappear from this country.
>
> In conclusion, I wish to reaffirm the vital essentiality of the horological industry for defense.

Secretary Teetor affirmed before the subcommittee that—

> The Department of Commerce, with particular emphasis on its responsibilities for mobilization planning and assuring adequate protection capacity to meet essential civilian needs, supports the position that serious damage would be done to the wartime strength of the United States if our domestic facilities for the manufacture of watches are permitted to deteriorate below the levels determined to be adequate for wartime expansion.

An interest in a more general part of our study was manifested by the Commission on Foreign Economic Policy (the Randall Commission). In its January 1954 report to the President and the Congress, the Commission stated:

> Our productive power is our mightiest weapon in war. Defense plants and workers cannot be stockpiled. * * * Industries vital to our defense should be maintained at reserve strength levels.

Although the subcommittee recognizes that it is not bound by the expert opinion which has been offered to it, we feel that we would be remiss in our duties if we failed to give this opinion the weight which its unanimity demands.

SUMMARY

1. The horological industry possesses unique, indispensable skilled workers who require up to 10 years of training and experience before they achieve proficiency in their crafts.

2. These skills can be retained only by continuous application in watch and clock making.

3. Without these skilled workers, the American watch- and clock-manufacturing industry cannot survive.

4. In a period of emergency, the Nation cannot rely on foreign sources for precision timepieces, other precision-timing devices, or jewel bearings.

5. The Nation has historically called upon the horological industry as its sole source of precision timepieces, its immediate and primary source for military precision-timing devices and for the development and production of other miniature and subminiature instruments.

6. Since the horological industry is uniquely capable of producing precision items to the most minute possible tolerances, the Nation will, in another emergency, again call upon the industry as it has in the past.

7. In a period of emergency, there is a military and civilian demand for the products of watch and clock makers which is greater than the supply which existing domestic capacity is able to satisfy.

8. There is a critical shortage of domestic jewel bearing productive capacity.

9. The jeweled-watch industry is uniquely equipped to mass-produce jewel bearings.

10 The jeweled-watch production of the jeweled-watch segment of the American horological industry is presently below a safe mobilization base level.

11. The trend of watch and clock production in the other segments of the industry indicates that it will soon be below a safe mobilization base level.

CONCLUSION

It is axiomatic that in time of national emergency, all components of our industrial machine are essential to the country's defense. American watch and clock makers, however, are peculiarly essential, not only in periods of crisis but, in the considered judgment of the subcommittee, in peacetime as well. Their availability in wartime depends upon a continuous peacetime existence at an operating level which utilizes, to the fullest extent possible, the unique, indispensable skills which the horological industry possesses.

RECOMMENDATION

The subcommittee recommends that the chairman of the Senate Committee on Armed Services transmit this report to the President of the United States and to appropriate officials of the executive branch of the Government for their immediate consideration, in order that the Executive may determine and prescribe effective means for the preservation of the critical skills of the watch- and clock-maker's art.

84TH CONGRESS
2d Session

SENATE

REPT. 2629
PART 2

DEFENSE ESSENTIALITY AND FOREIGN ECONOMIC POLICY

CASE STUDY: WATCH INDUSTRY AND PRECISION SKILLS

ADDITIONAL VIEWS OF SENATOR GOLDWATER AND REPRESENTATIVES WOLCOTT AND CURTIS

OF THE

JOINT ECONOMIC COMMITTEE

CONGRESS OF THE UNITED STATES

JULY 25 (legislative day, JULY 16), 1956.—Ordered to be printed

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84TH CONGRESS 2d Session } SENATE { REPT. 2629 Part 2

DEFENSE ESSENTIALITY AND FOREIGN ECONOMIC POLICY

CASE STUDY: WATCH INDUSTRY AND PRECISION SKILLS

JULY 25 (legislative day, JULY 16), 1956.—Ordered to be printed

Mr. GOLDWATER, from the Joint Economic Committee, submitted the following

ADDITIONAL VIEWS OF SENATOR GOLDWATER AND REPRESENTATIVES WOLCOTT AND CURTIS

It should first be emphasized that part 1 of this report is not a report of the full Joint Economic Committee. Instead, as is indicated on page 1, it is a report of a subcommittee, with additional comments, which was simply approved *for transmission* to the Congress by the full committee. It is specifically understood that approval for transmittal is not to be construed as adoption of the subcommittee's report by the full committee.

Certain of the conclusions and recommendations in the report are subject to the following criticism:

1. They go beyond the study of the subcommittee.
2. They are contrary to the arguments and observations contained in the body of the report.
3. They are inconsistent with each other.

On other conclusions and recommendations, though within the scope of the study and having a basis set forth in the report, in our judgment, the better logic points to different conclusions.

With this preamble the following observations are made:

1. *Comment.*—It is agreed that "a community of economically healthy nations devoted to living in harmony and tied by mutually beneficial trade" is "not the least factor of our national security." But in light of the subject matter of the report, it should be affirmatively stated, *and it is not*, that the greatest factor of national security depends upon the economic health of the United States.

2. *Comment.*—It is axiomatic that mobilization thinking must go far beyond *outmoded* ideas of continental defense, but how far must mobilization thinking go beyond up-to-date ideas of continental defense?

4. *Comment.*—The entire testimony about the possible types of future wars which the subcommittee itself found in its studies contradicts conclusion No. 4. The real conclusion is that it is not safe to make *any* firm assumption as to which type of war we might have to fight. Certainly, it is highly probable that we will fight a war where there will be time to convert our industry from war to peace. The time lag probably will have to be improved over the "period of years," the subcommittee assumes.

5. *Comment.*—The subcommittee made no study which justifies such a statement that "Thermonuclear war would destroy civilization and mankind everywhere." Certainly there is a school of thought which advances this idea, but there are many other schools of thought which take sharp issue with this bit of human conceit.

6. *Comment.*—It is hard to understand how the conclusion is reached that "economic support of this effort implies current production and stockpiling of material needed rather than massive conversion of industry." Of course, through the use of the adjective "massive," the statement is not so easily refutable. However, the very burden of the study is the question of how much industrial conversion might be feasibly planned for the various types of potential wars. The use of the adjective "massive" in a positive statement on another matter takes away the very point at issue and under discussion.

12. *Comment.*—This subcommittee made no study of tariffs versus other methods of trade regulation and is hardly in a position to comment upon the feasibility of one method of regulating trade over another without such a study.

13. *Comment.*—Just what does the term "like-minded nations" refer to? Like-minded on judgments of economic-political philosophy?

WATCHES

2. *Comment.*—This is directly contrary to what evidence the subcommittee adduced about possible wars in the future. One of the most likely of all wars is nonthermonuclear where Russian moves over the face of Western Europe with its land armies. Such a movement would amount to a war in which Switzerland is cut off from us and our own factories would still be intact. The decision as to whether a peripheral war is to become thermonuclear is largely one that the United States will make. In Korea, we decided against it. In Indochina, we decided against it. In the taking over of Czechoslovakia, not only did we decide against it, we decided to do nothing. In Greece we decided against it. Now on what basis does the subcommittee make such an assumption in recommendation 2 on watches?

3. *Comment.*—If conclusion 2 is unsupported, conclusion 3 falls also.

5. *Comment.*—It is hard to understand the data from whence it is concluded that trade restrictions will not preserve the domestic industry. The entire reason for the position of the Swiss importers is that they want the business; the position of the domestic producer is that they want the business. The trade restriction as presently drawn gives the business to the domestic producer. It isn't a question of "preservation" as such as much as it is a question of "growth" with the growing economy.

The argument that trade restriction is a burden on other industries and consumers can be applied to any restriction on anything. The question at hand is, Is the thing restricted against sufficiently detrimental to the part that it in effect is detrimental to the whole?

7. *Comment.*—This conception is amoral and inconsistent with the previous conclusions of the committee. In conclusion 13, the subcommittee argues for the need of the United States to stay committed to "a policy of intervention in world affairs." "This requires our consistent application of principles designed to encourage economic growth and progress throughout all like-minded nations of the world; a timorous and inconsistent policy with principle sacrificed to temporary expedience will weaken true national security," the subcommittee states.

The United States has antitrust laws to restrict against trusts, cartels, and many other attempts of persons to gain monopolistic control over economic powers. We do that in the firm belief that not to do so will discourage economic growth and progress. Now either we believe this is true or we do not. Either we believe that minimum-wage laws and laws against sweatshops do encourage economic growth and progress and that permitting the opposite will discourage it, or we do not. We either believe that our health regulations that we impose on our domestic producers are in the interest of the health of our consumers and of our society or we do not.

This doctrine advanced by the subcommittee in this recommendation that "we have no valid reason for dictating the form of internal business organization in a foreign country" can only come logically from a belief that these restrictions we place on our own domestic producers are just window dressing, voter appeal stuff, matters that have no relation to reality. Certainly if the members of the subcommittee and the staff who prepared this report believed in the economic merit of antitrust laws, minimum-wage laws, health laws, and all the other restriction we place upon our domestic manufacturers, they would see that the only way we can help spread economic growth and progress in foreign countries is through an insistence upon paying attention to these standards.

Nor do we have to go as far as the subcommittee does in its recommendation 13 in the extent of United States intervention abroad in this matter. The subject matter at hand concerns a question of foreign countries wanting to sell their goods in the United States domestic market. We surely have the right to impose a little "intervention" here to say to the foreign producer, we have certain economic regulations imposed upon our domestic manufacturer which we feel are necessary to maintain this great domestic market we have built and to protect our consumers and we expect you to pay some attention to them too if you want to gain the benefits of trading in it.

In essence, the presentation of the subcommittee is the same argument that used to be used domestically in favor of sweatshops: the consumer gets the benefit in price. Well, we have concluded in this country that, though the consumer may get an immediate benefit in price from sweatshop labor, in the long run neither the consumer nor any one else derives benefit from exploitation of other men's labors.

For over 10 years now we have been following the mixed-up philosophy, the same that is herein advanced by the subcommittee in its recommendations and conclusions, in our foreign policy. It has not done well in stemming communism in the world either ideologically in the hearts of men or physically in the broad lands of the world. The reasons why this foreign policy has not succeeded should be obvious by now. We have not been promoting the political and economic philosophy which made this country what it is, the philosophy of high wages, good working conditions, fair trade practices, rules against economic monopoly (including the worst kind of economic monopoly, that controlled by the political government). Those who have been charged with setting up and administering our foreign policy, from their actions, seem to have no concept of what the virtues of private enterprise are. They have taken this great society in the United States for granted and then have gone abroad and condoned and indeed encouraged the very economic practices which we had to fight against over a period of many years in this country in order to have the system that we do have.

If we are indeed to promote economic growth and progress abroad, we had better start paying attention to the things that produced the economic growth and progress in this Nation. The laws of economics and sociology are just as true abroad as they are at home.

BARRY GOLDWATER.
JESSE P. WOLCOTT.
THOMAS B. CURTIS.

APPENDIX IV

ADDITIONAL MATERIAL SUPPLIED SUBSEQUENT TO HEARING OF BULOVA, ELGIN, AND HAMILTON WATCH COS.

STEPTOE & JOHNSON,
Washington, D.C., August 28, 1964.

Senator STUART SYMINGTON,
Chairman, Special Subcommittee of Senate Armed Services Committee, Old Senate Office Building, Washington, D.C.

DEAR MR. CHAIRMAN: I submit for the consideration of the subcommittee testimony of Mr. Harry Henshel, president of Bulova Watch Co., and Mr. David Anderson, vice president of Bulova, which was taken by the U.S. Tariff Commission on May 14, 1964. This testimony covers the following significant points:

1. "Watchmaking" skills as that term is used by watch manufacturers is an order of skill entirely different from that of the so-called watchmaker in jewelry establishments engaged in repair of watches.

2. Importation and assembly of watch parts in the United States will not preserve the watchmaking skills of U.S. manufacturers.

3. Research and development facilities of U.S. jeweled watch producers cannot be maintained in the United States if watch manufacturing ceases.

I would also like to submit for the record references to three opinions on the question of whether the skills of the watch industry necessary to national defense could be preserved by using them solely on defense work and other nonwatch activities. The importers have constantly maintained that watch production is not necessary to maintain these skills. Nothing could be farther from the fact.

First, I enclose a copy of a report of Arthur D. Little, Inc., which was submitted to the Office of Defense Mobilization in January 1957. The conclusion of Arthur D. Little stated on pages 31 through 34 bear upon the above question.

Second, in its report to the President in July 1954, the majority of the Tariff Commission concluded as follows:

"The forces now dominant in the watch trade are such that if present tariff rates are not increased as recommended by the Tariff Commission domestic watch manufacturers will undoubtedly find themselves able to supply only a constantly declining share of the domestic watch market, and will be obliged to reduce their aggregate absolute output of watch movements. Participation in the production of war materials has tended to obscure the serious deterioration that has already occurred in the domestic industries. Such production of war materials offers only precarious, short-lived opportunities, and once these come to an end, domestic manufacturers must again depend entirely upon production of watches for the civilian market. The well-being of the industries producing jeweled-lever and pin-lever watches and watch movements has been seriously impaired by ever-increasing imports; the remedy lies in restoring to those industries greater participation in this U.S. market. In no other way can the facilities for making watches and perpetuating watchmaking skills in the United States be assured, and the maintenance of these facilities is vital to the national defense."

Third, in 1954 a special interdepartmental committee on the jeweled watch industry made a report to the President in which it considered the question whether watchmaking skills necessary for defense could be preserved without continued application to watchmaking activity. The committee concluded as follows:

"It is, therefore, not sufficient for national security purposes merely to maintain the facilities for jeweled movement production on a standby basis. It is the skills that must be maintained. This can be done only by the actual production of jeweled watch and clock movements or the parts of such movements."

These materials are submitted on behalf of Bulova, Elgin, and Hamilton watch companies.

Sincerely,

PAUL F. MICKEY.

TESTIMONY OF DAVID ANDERSON, VICE PRESIDENT OF BULOVA WATCH CO., BEFORE THE U.S. TARIFF COMMISSION, INVESTIGATION NO. TEA I-A-2, MAY 14, 1964

Mr. MICKEY. I don't know whether this is for you or Mr. Henshel, but let me ask if you were to become an importer of parts and assembler in the United States, would you be able to utilize those people that you now employ at watch movement production manufacture in parts assembly?

Mr. ANDERSON. Well, that question really I think should be answered in two parts. One part I think I would rather give to Mr. Henshel, because this is something that we have weighed at great length and that is the very question that you have asked we have asked ourselves.

Would we consider as an alternative to remaining alive domestically speaking as a complete manufacturer, consider reducing the scope of our manufacturing activity, and relying to a substantial degree on importation of parts.

I would like to ask Mr. Henshel to field that one, but I would like to answer the second part.

On the assumption that this might happen, if it were to happen, I would say that most of the personnel who are involved in manufacture and in assembly as well, but particularly in terms of manufacture, would be no longer required.

There would be many problems which would have to be resolved, and I fear that many of them would have to be resolved on the basis of curtailment. Much of the toolroom machine design, engineering, process development activities which are now supported on a broad base of manufacture would be exceedingly difficult to support on an ever-narrowing basis of manufacture, and so as I see it, this question of whether we could change our personality, so to speak, and become half importer of parts and half manufacturer of parts is one which, in effect, would, if answered affirmatively, involve an understanding on our part that we were engaging in a process which Mr. Sinkler described this morning as a process that would be irreversible, and which I would describe further as being a process which would be not only irreversible, but once started would be very difficult to control, very difficult to limit.

With that perspective and with that view, I would say that the overwhelming majority of those who are now employed in the manufacture of parts, including of course those who support manufacture in terms of engineering and processing and toolroom, machine building, would lose employment.

Their loss of employment would in effect mean the loss to the Government and to the industry of the capability of our skills in the areas represented.

TESTIMONY OF HARRY HENSHEL, PRESIDENT OF BULOVA WATCH CO., AND DAVID ANDERSON, VICE PRESIDENT OF BULOVA WATCH CO., BEFORE THE U.S. TARIFF COMMISSION, INVESTIGATION NO. TEA I-A-2, MAY 14, 1964

Mr. MICKEY. Mr. Lazrus referred to the skills of watchmakers. And I think he said that there was some—that Benrus had some skilled watchmakers, and he referred to watch repairmen. Is there a comparison between a watch repairman in terms of skill with the skilled workers that you have who actually make parts and perform other operations in the manufacture of a complete jeweled lever movement?

Mr. ANDERSON. No, Mr. Mickey. In fact, there is very little in common between the skills represented by watchmakers engaged in casing of watches or in repair of watches, and even to a large degree in basic assembly of a complete watch, with the skills that are engaged and involved in the manufacture of watch movements and watch components.

I think, for example, reference merely to such diverse activities as the design and manufacture of very complex dies, cutters, jigs, fixtures, machines, operation of a wide variety of very complex, very delicate manufacturing and fabricating equipment, is perhaps sufficient to indicate that the skills and the technology involved in the manufacture, in the basic sense, of a watch, have very little in common with the work involved in merely putting together and adjusting and finally assembling these components in the final assembly of the movement.

As Mr. Siegler indicated this morning, the technology in recent years has tended to emphasize a greater degree of precision, a greater degree of mechanization, and a greater degree of sophistication in parts manufacture, all calculated to minimize the importance and to minimize the demands for watchmaking skills in the sense of assembler skills, in the sense of adjuster skills, in the sense of people highly trained in manual dexterities and in manual arts, to file, to fit, to adjust, and form.

Basically, there is very little in common between the skills required to function in the assembly area as such, as differentiated from the manufacturing area as such.

Mr. MICKEY. Mr. Anderson, is Bulova Watch Co. supplying the management and technical capability for the Turtle Mountain Ordnance Plant?

Mr. ANDERSON. Yes; the Turtle Mountain Ordnance Plant is, of course, a Government facility, and our contribution to that facility is supplying to the technical and management skills.

Mr. MICKEY. Would the plant have been able—would the Government have been able to establish that plant without some outside technical capability?

Mr. ANDERSON. Well, others may disagree, but I would say no.

Mr. MICKEY. Was there any source in the United States for technical and management skill outside of the jeweled watch companies that you know of?

Mr. ANDERSON. No; none that I know of.

Mr. MICKEY. This is a plant that manufactures jeweled bearings.

Mr. ANDERSON. Yes.

Mr. MICKEY. Which was established by the Government on the recommendation of the Office of Defense Mobilization, Department of Defense; is that correct?

Mr. ANDERSON. Yes; that is my knowledge.

Mr. MICKEY. As far as you know it is the only plant in the United States that produces jeweled bearings independently of importation—that is, from the raw material—is that correct?

Mr. ANDERSON. That is correct—with perhaps only this reservation, which in the interests of accuracy should be made.

The plant at North Dakota purchases blanks of sapphire which have already been cut into squares. They do not actually begin with the basic raw material.

Mr. MICKEY. You mean they do not manufacture the raw material. But this is a very large mass of raw material?

Mr. ANDERSON. Yes.

Mr. MICKEY. Mr. Chairman, I have no questions at this time.

Chairman DORFMAN. Mr. Fenn would like to ask some questions.

Commissioner FENN. I am still having a little trouble with this question that I asked Mr. Sinkler, and that is the relationship between R. & D. capacity and incentive for R. & D. and the location of manufacturing facilities.

The Accutron is not a watch, according to Bulova; is that right?

Mr. HENSHEL. Well, for the purpose of this proceeding, shall we call it a watch and make it much simpler?

Commissioner FENN. Is that on the record?

Mr. HENSHEL. That is on the record.

Commissioner FENN. Could not the research have been done here and the manufacturing been done elsewhere, as was done with the women's movement that you mentioned during your testimony here?

Mr. HENSHEL. It was first engineered and produced here, and then there, and that was many years ago.

I don't believe it could at all.

I believe Mr. Anderson could explain why.

Mr. ANDERSON. To answer directly your inquiry, I would say in my opinion, no, it could not have been engineered here and put for manufacture elsewhere. If you wish, I could go into some elaboration of that.

Commissioner FENN. Well, the position, as I understand it, that you are taking that the research and development capability of Bulova depends upon the maintenance of a jewel manufacturing capability and facility in the United States.

Mr. ANDERSON. Yes. That is essentially correct.

Commissioner FENN. I am having trouble with this.

Mr. ANDERSON. Well, then, if I may, perhaps that is worthy of some elaboration.

Firstly, let me say that in the design, that is to say the creation of a new watch, there is far more involved than engineering in the sense of drafting work activity.

Parts have to be made. And since the very nature and character of these parts are such as to preclude their commercial manufacture in nonwatch establishments, before designs can be firmed up, processes for manufacture must be carefully weighed and carefully chosen with reference to the state of art capabilities, and with reference to proving out step by step proposed design innovations.

Generally speaking, in this type of endeavor, there is a very, very close interplay between what we might term engineering activity and prototype and model making activity, and production activity.

To illustrate with perhaps one illustration—in a design of a new escapement, for example, drafting board analyses can be carried only to a point where actual test and evaluation of hardware must take place before further feasibility and economics of production can be established.

Generally speaking, it is not feasible to make such evaluation hardware unless the process by which those components are proposed to be manufactured are readily at hand.

Very, very frequently, the very people who are building the prototypes and constructing the evaluation pieces, the test hardware, are also the very, very individuals who are responsible for a determination of basic design direction.

So that in a sense, and a very real sense, when a new watch movement or a significant innovation in a horological device of the kinds we are talking about are being undertaken, the basic environment in which they can be successfully carried on is one which requires that there be readily available to the engineering personnel, to the development personnel, all of the kinds of inputs in terms of manufacturing know-how and in terms of access to manufacturing tools and equipment which are normally found only in a watch manufacturing facility that is actually in being.

Commissioner FENN. Now, to the extent that you cannot put together in your laboratory the necessary manufacturing facilities on a small scale to do this sort of evaluation and testing, can't you use your Swiss facility as your area?

Mr. MICKEY. May I say, Mr. Commissioner, I think Mr. Sinkler did not say that he had to have a research laboratory in the United States. His testimony was that they had to be together. They could be together in Switzerland, or they could go together in the United States.

Commissioner FENN. In other words, it is conceivable that Bulova, for instance, could maintain its innovation and continue to develop new products and so forth and so on without the maintenance of a jeweled lever production in the United States.

Mr. MICKEY. Yes—if it had a research laboratory associated with a production facility somewhere else.

The point that Mr. Sinkler was making with respect to that was simply that without domestic watch manufacture in the United States to support it, Hamilton could not maintain its rather extensive research facilities in the United States, and that building and those people and those facilities would go, too.

Commissioner FENN. So that the interplay is so close that getting on a plane and going to Switzerland in a few hours is not sufficient—doesn't give you sufficient integration?

Mr. MICKEY. No—it is the people working every day together.

Mr. ANDERSON. Mr. Commissioner, if I may add to that, this is true even to a degree where I believe it is quite correct to state that it has been the practice in horology that whenever a new movement caliber is being contemplated or designed, that it is designed specifically for a specific in being collection of all machinery.

That is to say, if Bulova, for example, were to take a caliber which it has designed for manufacture in its own facilities in Jackson Heights, it is very, very likely that that caliber could not be transferred to another factory elsewhere, either in the United States or abroad, without considerably revamping, for the reason that when that caliber is designed in the first instance, the design of each individual component is made with a specific process and a specific set of machines in mind.

This carries even to the degree that we who have a plant in both Switzerland and in the United States, and who try, as far as we can, to maintain the highest degree of interchangeability between our basic equipment, nevertheless, must face the reality that in many, many instances our equipment here in the United States is significantly and sufficiently different from its counterpart equipment in Switzerland that in many, many instances they cannot undertake, without substantial retooling, the use of our tools, the use of our part drawings for specific component manufacture.

Mr. MICKEY. Mr. Commissioner, I would like to add this one observation.

Of course, it is not impossible to have an independent research facility, if you equip the research facility with all of the attributes that are available to it when it is in connection with a manufacturing operation. But at that point it becomes so expensive in itself, that nobody would afford, I think, or certainly American companies would not afford to undertake the extra burden of maintaining a facility that would be separate from a manufacturing facility, so they would put it in a place where there was a manufacturing facility.

Commissioner FENN. Let me just ask one more question, and then let this one go.

Is there something about the watch industry which makes it different from other industries where there is a fairly considerable time lag between the initial development of an idea and the point where you have to link it with the production process which is the time that you need to get close to your manufacturing facilities—where the engineers begin to take over from the research people?

Mr. MICKEY. I would not undertake to answer that question, myself. Mr. Sinkler will answer it.

Of course, maybe you have to relate it to a comparison with some other industry.

Mr. SINKLER. Mr. Fenn, it seems to me—I now see what you are getting at.

Yes—we can hire Arthur D. Little, for example, to design a product for us. The first thing they would do is send their men down to our factory and see the machines on which it is ultimately to be made. A designer or researcher cannot work in a vacuum.

Now, we could maintain a basic research facility here, and have a plant halfway around the world. But at some point the engineer who is doing the designing and the development of this new product would have to move to the machinery that is going to make it, or we would have to move the machinery to the engineer and set up, in effect, a pilot plant operation, which in my opinion would be an uneconomic way of doing it.

So when I said that we would not maintain a separate one—the economics of it wouldn't justify it. Sooner or later, you have to get the designer and the manufacturer together.

Mr. HENSHEL. I can add to that a little.

First of all, Accutron, as an example, has had about a hundred engineering changes in its 4 years, and is still—while it is in full manufacture in the United States—is still under control of its original development engineers. And I don't know when they will let go.

Second, we have a tool and die making facility in France, which makes tools both for Switzerland and the United States, but in this we have a great deal of difficulty because of the distance, even on something as basic as a second set of tools from drawings already in existence.

I think Mr. Anderson can explain further on that.

Mr. ANDERSON. Well, I think the basic point has already been made: that the nature of this product is such, in summary, that the drawing has to be made with a specific collection of machinery and processes in mind. And everything which tends to separate the design group from the process, from the equipment, and from the people who are going to have to build and live with the tools, in effect, jeopardizes the utlimate result, which is the product at a cost.

REPORT ON AUTOMATION AND WATCHMAKING SKILLS

Office of Defense Mobilization, hearing on jeweled watch industry, January 7, 1957, presented by Joseph Harrington, Jr., of Arthur D. Little, Inc., on behalf of Bulova Watch Co.

INTRODUCTION

My name is Joseph Harrington, Jr. I am a member of the staff of the Mechanical Engineering Division of Arthur D. Little, Inc., research engineers of Cambridge, Mass. I am presenting this statement on behalf of that organization. The statement was prepared in collaboration with the following other senior staff members of Arthur D. Little, Inc.; Mr. Allen Latham, Jr.; Dr. Frank Maurer; and Mr. Philip Donham. Mr. Latham is with me here today.

Some months ago our organization was retained by Bulova Watch Co., generally to study the feasibility of further automation in its manufacture of watches and specifically to attempt to determine whether automation will eliminate the value of the skills of the watch industry, as exemplified by Bulova, to the national defense.

I am submitting with this statement an appendix A-1 setting forth the experience and qualifications of our organization. Briefly, Arthur D. Little is one of the oldest and largest firms of consulting research engineers in the country. Founded in 1886, it now numbers some 900 persons. We specialize in the application of scientific knowledge to the solution of problems, whether the problems be those of management, government, or production; mechanical, chemical, electrical, physical, metallurgical, biological, or mathematical. I am also submitting as appendix A-2 a brief statement setting out the qualifications and experience of the particular staff members who made the study.

To introduce myself, I graduated from MIT in 1930, and received my doctorate in 1932, having majored in mechanical engineering and minored in mathematics. Since then I have devoted my entire life to the design of automatic machinery, and the economic and technological environment of machinery and production systems. I have designed shoe machinery, electronic equipment assembly systems, and a number of weapons and fire control systems for the Armed Forces.

I should add that among the many members of the total staff of the organization there is a vast accumulation of knowledge concerning manufacturing processes and the application of automation, and that, of course, this knowledge was available to, and tapped by, the particular staff members who made the study. One of the services rendered by the organization, for which it is constantly being retained by manufacturing companies, is the analysis of production processes of various kinds, such as was made in this case.

DEFINITIONS

In order to avoid semantic difficulties in our discussion, it is appropriate to define three words which we wish to use in this report. These words are "automation," "mechanization," and "automatic."

Automation is a recently coined word widely and variably defined by the many "authorities" on the subject. We intend to follow the usage of the first definition adopted by an industrial association:[1]

"Automation is the technique of improving human productivity in the processing of materials, energy, and information by utilizing, in various degrees, elements of self-control and of automatically executed product programing."

The important concept here is that automation is a technique, practiced by engineers and economists, who apply scientific methods to the solution of industrial problems. Automation is not a new and magical kind of machinery, nor a "black box" full of electrons, nor some superior variety of pushbuttons.

Mechanization is the replacement of human skill and strength by machine skills and power. Here we may construe the machine to be an electrical or chemical or thermal device as well as a mechanical device. An operation may be mechanized wholly or in one of many degrees. For example, suppose the operation is to drill a hole in a lot of machine parts. The operation breaks down into these suboperations:

(1) Transport: Get the parts to the drill press.
(2) Select: Separate one part from all the others.
(3) Orient: Get the part right side up, etc.
(4) Position: Locate the part precisely with relation to the tool.
(5) Clamp: Lock the part in place.
(6) Operate: In this case, drill the hole.
(7) Release: Unlock the holding fixture.
(8) Eject: Remove the finished piece from the machine's work area.

Any one, several, or all eight of these may be done by a machine rather than by a human. Usually, the first step is to mechanize tool control and actuation. An electric motor rotates the drill, and also acts through a train of gears to feed it into the work. The next stage might be the addition of a jig in which the part is cradled inevitably in the correct position. Many Bulova machines are at this stage of mechanization. The punch presses also commonly perform

[1] Automation Committee, Radio-Electronics-Television Manufacturers Association

the release and ejection of parts by machine. The Bulova assembly conveyor has mechanized the transport and selection functions only. The pinion leafing machine performs steps 2 through 8 by machine, and could, therefore, be said to be highly mechanized.

"Automatic" is an adjective which describes a kind of mechanism. When a machine is so designed as to repeat a movement, or a cycle of movements, over and over again, it is described as automatic. It is not uncommon to see each new level of mechanization hailed as achieving "automatic" thus and so. Screw machines are known as automatic screw machines because they follow an intricate preordained program of movements. But even when many such machines are integrated by conveyor belts into full production lines, as for example in the cylinder block plant of the Ford Motor Co., the elements are still just automatic mechanisms. The word "automation" is properly applied only to the activities of the engineers who achieved this full mechanization.

Not all industrial fields are properly subjects of automation activities. To develop automatic machinery is expensive, and to build the machines is also expensive. These costs must, in a normal economy, be recovered from savings in the cost of the product; or in the reduction of skill or training time required of the operator; or in the upgrading of quality of the product. Furthermore, the operation performed must be repetitive and it must be feasible to mechanize it. The painting of a portrait in oils, for example, involves the exercise of artistic judgment and nonrepetitive color mixing and brush strokes which could scarcely be described as subjects for mechanization. On the other hand, the printing of a color reproduction of the oil portrait in an offset press is a repetitive operation, and can be mechanized.

THE INVESTIGATION

In making this study Messrs. Latham, Maurer, Donham, and I, and a Mr. Reswick, of MIT, consultant, have collectively spent a number of days at the Astoria Boulevard plant, and have met and discussed this subject with Bulova management, and Bulova production people.

We had full and free access to the plant and the records of Bulova. Experienced men devoted full time and attention to explaining the methods, machinery, and skills involved. Drawings of parts, time studies, process sheets, and cost records were made available. Typical personnel records were examined and the work people observed in action. The comptroller made financial records available to us.

Our first step in making the study was an analysis of the watch parts manufacture and the watch assembly, to determine what operations possessed the requisite characteristics for mechanization; also the present status of the mechanization program for that operation. It requires some 2,000 manufacturing operations to produce the 119 parts of a typical watch, and further operations to assemble and adjust it. It was obviously impossible to survey this entire mass of activity in the time available. Some simplification was necessary.

A list was given us showing the name, number, and cost of every part in a watch. From this list the purchased parts (jewels) were eliminated. Next we segregated a group of simple parts each costing less than 1½ cents a piece. These parts—pins, screws, and simple stampings—are this inexpensive because of their simplicity, which calls for few machining operations, and because of the already high degree of mechanization in their production (punch presses, automatic screw machines). The production rate on such machines is high, and the direct labor involves merely loading and unloading the machine. Even the indirect labor of machine setting for such parts does not require as great skill as would be required in setting up machines for other parts to be mentioned later. Furthermore, the potential economic target presented by such cheap parts, even in very large lots, could not justify major engineering effort.

After eliminating these parts, therefore, we had 37 parts left, which I have listed in an attachment to my statement, called appendix B. We proceeded to study the manufacture of these parts.

Although no two parts are identical, they do fall into groups, each with a typical set of operations. The operation sheets for all the parts in the watch were made available to us, and we selected a typical one from each group. We observed the operations involved in making the typical part to determine the skill involved, the type of employee, the training period, the machine used, the gages used, and the number of people doing each kind of operation. We also discussed the status of mechanization of each operation.

FINDINGS

As a result of the study, we came to the following conclusions relevant to the subject of your inquiry:

1. There are workers in the jeweled watch industry whose skills are not likely to be replaced by machinery in the foreseeable future. Some of these skills are exercised by operators engaged in the actual production of watch parts, using judgment and manual dexterity in handling the tiny and delicate parts. Other skills are exercised by technical supervisors, toolmakers, and inspectors.

Replacement of these skills by machine in many cases is not mechanically feasible, and in others is so difficult in terms of both money and time as to be economically unjustifiable.

2. These skills are unique to the watch industry. They are characterized by the handling of extremely small and delicate parts; by working to very small tolerances while producing large quantities of parts; and by the use of horological knowledge. Also, there is a unique skill possessed by the whole team working together as a unit.

3. We believe that these skills are of value to the national defense, and will undoubtedly continue to be of value. This is borne out by the record, and it can be anticipated that future military requirements will call in even greater measure for miniaturized precision instruments which this industry can produce.

4. We further believe that the application of the technique of automation to the production of defense items would not eliminate the value of the key horological industry skills. In a world rapidly evolving weapons, one can neither freeze the product in order to mechanize its production, nor can one mechanize the production of weapons as yet not developed.

5. Finally, we are convinced that a team in industry such as that of the watch industry must be kept together and at work or its skills will atrophy. Machines may be put in mothballs, but people cannot be mothballed, and a team, once disbanded, is gone forever.

I

There are workers in the watch industry, as exemplified by Bulova, whose skills are not likely to be replaced by machinery in the foreseeable future. Their work can be subdivided into two general classes: direct production, and work which includes technical supervision, tooling services, and inspection.

For the purpose of this study, we have eliminated from consideration workers whose training period is less than 2 years. The skills of such relatively unskilled workers can presumably be made available, if needed, to national defense from other sources than the watch industry.

A. *Parts production and assembly*

On the foregoing basis, although many of the production workers on Bulova's payroll may be excluded from consideration as relatively unskilled, there are nevertheless a significant number of direct production workers who do possess higher skills which require more than 2 years' training.

Each of the more complicated and expensive watch parts is the result of many (sometimes 150) separate operations. Most of these require the operator to handle the parts, frequently with tweezers and, not uncommonly, to use a loupe[2] to assist in seeing the part. All operators are required to load and operate their machines, to use gages to inspect the parts being produced, to stop the machine if the parts are not up to standards, and, in some instances, to make minor adjustments, such as changing a drill, to restore the accuracy of the work.

In the past, Bulova has successfully mechanized most of the operations which shape watch parts and has equipped the machines with jigs and fixtures, so that the operator merely picks up a part, places it properly, actuates a clamp, and sets the machine in motion. Later she removes the finished part and may check it in a gage.

The foregoing description is characteristic of the majority of operations. The skills required can be picked up in less than 2 years.

1. But after eliminating such workers, there remains a group of production workers who require more than 2 years' training. They are workers who are

[2] Jeweler's magnifying glass.

involved in the manufacture of the hairspring, balance wheel, and pallet. These are the parts which produce the accurate measurement of time, as distinct from other parts which supply power (mainspring) or transmit motion (gear trains) or form the framework (plates and bridges). Most of these tasks require judgment as well as digital dexterity and visual acuity.

The task performed by an operator which requires the long period of training may not be the only task performed by that operator at Bulova, and other watch factories may assign the skilled task to another kind of person with another job title. I have, therefore, correlated in the following table the task requiring skill, the occupational title as defined in the "Department of Labor Dictionary of Occupational Titles," and the job title as used at Bulova. To avoid confusion, appendix C gives an informal description of the task.

Task requiring long training period	Bulova's name for person who does this task	"Dictionary of Occupational Titles"
Watchmaking	Various. All groupleaders are watchmakers.	Watchmaker.[2]
Hairspring truing	Hairspring truer	Hairspring truer.[1]
Hairspring vibrating	Hairspring vibrator	Hairspring vibrator.[1]
Hairspring winding	Hairspring winder	Hairspring winder.[1]
Balance wheel poising [3]	Poiser	Poiser, balance.[1]
Pallet stone setting	Pallet stone fitter	Pallet-stone positioner.
Roller jewel setting	Roller jewel setter	None.
Watch parts inspecting	In process inspector	Inspector, watch parts I.[1]
Guard pin adjusting	Guard pin adjustor	None.
Banking pin adjusting	Banking operator (or assembler)	Banking adjuster.[1]

[1] 2d edition, March 1954.
[2] Modifications, July 20, 1956.
[3] The poiser at Bulova uses a machine to hold the part, remove the metal, etc.; it is, however, only an adjunct to the skill of the human operator. We understand that other watch companies may use methods calling for less sophisticated machines and considerably less skill on the part of the operator, but because they defer much of the refinement of poising until the watch is assembled and is being adjusted, balance poising is described by them as a machine operation. Actually the work has to be done, but is done, at a later stage and by a person carrying a different job title.

2. With few exceptions, these workers are not likely to be replaced by machinery in the foreseeable future, for several reasons:

First, we examined these individual operations and found but few which we consider it possible, let alone probable, to mechanize purely on the basis of mechanical feasibility. We examined the classes of skills present in these operators and found few doing repetitive work sufficiently free of judgment to be subject to mechanization.

It must be obvious that an automatic machine must do the same thing over and over again. Hence, it must be given uniform parts on which to work, and it must always do the same thing to them. The operation is repeated on every part and the machine will exercise only rudimentary judgment in varying this operation. There are, of course, machines which do exercise true judgment, but their cost, complexity, and maintenance are such as to rule them out of such applications as we are here discussing.

Second, mechanization where applicable has already been carried a long way. As we studied representative operations, we noted many automatic machines, some of which had been in use for many years; others, such as three special machines for making the escapement wheel, are new. The machine complement of the Jackson Heights plant is evidence that mechanization has been in process throughout the past 20 years.

We also raised a question as to further mechanization in a few specific instances which came up during our study. In most instances the possibility had already been perceived by Bulova personnel and analyzed. It had either been rejected as unprofitable or nonfeasible, or mechanization was underway at that moment. Parenthetically, one of the pitfalls of automation is overmechanization. It frequently works out that a seemingly economical and practicable device is unjustified because it makes no real reduction of labor or increase in output. For example, an operator feeds a screw and a lever to an assembling jig; the screw feeding could be done by a hopper and raceway, but the operator still must be there to handle the other part and might just as well feed the screw with her left hand.

An accepted criterion of the progress of mechanization is the man-hours expended per unit of production. Worker productivity increases as power tools supplant hand power, and high-speed machines replace slower manual operations. The basic design of watches has not been greatly changed in recent years, so that by plotting man-hours per watch against time in years, we can visualize the progress of mechanization.

Figure I, based on data prepared by Bulova, shows the relative number of man-hours of labor required for Bulova to make a watch movement in the United States, using 1945 figures as 100 percent. The significant progress in the past 10 years is obvious.

The chart also suggests that equal amounts of effort in the future will produce less significant reductions in the man-hours, as the problems of labor savings become more and more difficult to solve. This can be better appreciated when we think of the man-hours of labor now expended per watch as the equivalent of only a few seconds for each operation.[3]

Based upon his knowledge of watch manufacture, both in the United States and in Switzerland, Mr. Arde Bulova has informed us that Swiss man-hours per watch are about 5 percent in excess of U.S. man-hours. Bulova Watch Co. is in the unique position of having factories in both the United States and Switzerland. The methods employed by its Swiss factory at Bienne are typical of Swiss manufacture. In addition to assembly work, the Bienne plant performs some production operations, although in the main—like other Swiss plants—it buys from others the parts it assembles. Mr. Bulova is in a position to compare the limited production operations in Bulova's Bienne plant with the corresponding operations in its plant at Jackson Heights, Long Island.

This comparison shows that in none of the operations is the Swiss plant more efficient than the American plant. In the four operations (identified in Bulova's supplemental confidential brief) listed below, the American plant is distinctly superior to the Swiss plant.

Production in pieces per man-hour

	Bulova Watch Co.	
	Bienne plant	Jackson Heights plant
Operation:		
A	240	2,500
B	200	1,000
C	150	400
D	300	1,300

The difference in productivity is due, not to a difference in skill, but to a difference in the equipment used.

3. Further mechanization is becoming more and more marginal from an economic point of view.

It is obvious that the first objectives of an automation program would be the easy jobs, because they involve less investment in engineering, and the lucrative jobs, because they offer the greatest savings with which to offset costs. Most such objectives have already been reached, and the remaining objectives become more difficult or less lucrative, or both, with every step.

In a normal economy automation is expected to produce a net savings in production.

We find the manufacturing cost of the watch movement to be surprisingly low, approximately 10 cents a part. The total direct labor, which is of course the chief target of mechanization efforts, amounts to 46 percent of the manufacturing cost of a typical Bulova watch.[4] Raw materials cost, aside from jewels, is an insignificant amount and presents little target for automation. For example, $90 worth of a special alloy steel wire becomes $30,000 worth of hairsprings, as a result of the labor expended upon it.

[3] We understand that actual figures on man-hours and costs are to be included in Bulova's confidential supplemental brief.

[4] We understand that actual figures on man-hours and costs are to be included in Bulova's confidential supplemental brief.

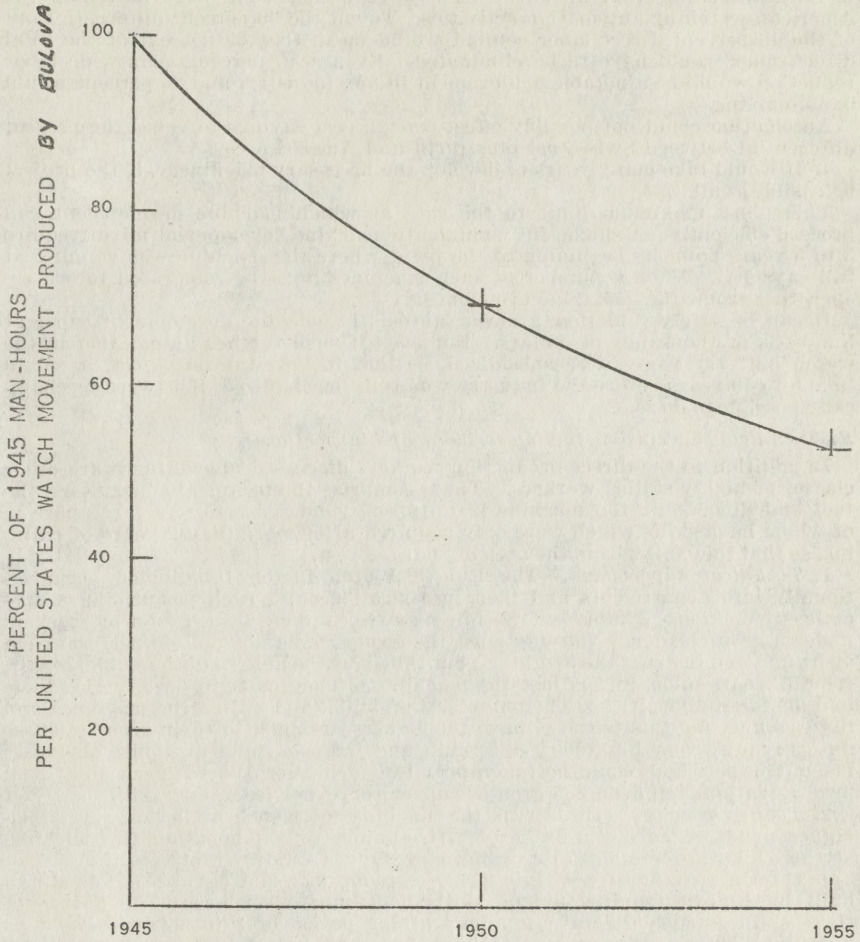

FIGURE 1

PROGRESS OF MECHANIZATION

MEASURED IN RELATIVE NUMBER OF MAN-HOURS OF LABOR REQUIRED TO MAKE A WATCH MOVEMENT IN THE UNITED STATES

A Swiss watch movement plus tariff costs only 70 percent as much as the comparable American watch movement cited above, according to Bulova's figures. It is inconceivable that an offsetting cost reduction could be achieved in the American watch by automation activities. To cut the 30 percent differential out of the 46 percent direct labor content would mean that 69 percent of the total direct labor would have to be eliminated. Even a 10 percent, plantwide labor reduction would be a notable achievement in any industry, and 25 percent would be astounding.

Automation could not possibly effect enough cost savings to equal the present differential between Swiss cost plus tariff and American cost.

4. It would take many years to develop the necessary machinery, if the project is feasible at all.

There is a maximum limit to the rate at which machine development can proceed efficiently. A single, fully automatic machine development might require 3 to 5 years from its beginning to the point where the machine was running at full capacity. When a number of such machines must be integrated into a cooperating group, the task takes even longer.

It can be safely said that a major automatic machine development can cost hundreds of thousands of dollars. But even if such further automation in the watch industry were to be subsidized, so that money was no object, it would take 5 to 10 years before the industry was fully mechanized, if it were mechanically possible to do so.

B. Technical supervision, tooling services, and inspection

In addition to the direct production workers discussed above, there are other classes of highly skilled workers. These comprise the technical supervisors, the tool and diemakers, the machine setup people, and inspectors, a large portion of whom have skills which were only acquired after more than 2 years of training, so that they fall within the area of your interest.

1. *Technical supervision.*—The Bulova Watch factory is divided organizationally into departments and then into small groups, each performing a specialized function. Pinion leafing, for example, is done by a group of workers under a group leader. Not only must the group leaders be able to perform each operation and instruct the operators, but they must be able to disassemble, repair, rebuild, reassemble, and adjust the machines. They must inspect the products and diagnose difficulties. They may design, build, and adjust the machines and fixtures and, for this purpose, have toolmakers assigned to their group. These duties require very high degrees of skill and judgment and are quite obviously not of a type which could be taken over by machines. Indeed, each additional mechanization step demands greater supervisory knowledge and skill.

2. *Tooling services.*—Insofar as the machine tools such as lathes, screw machines, drills, etc., are of a design and size unique to watchmaking, the machine-setting skills are unique to the watch industry. Certainly the "setting up" (see app. C for an explanation of this term) of tools, jigs, and fixtures designed and built by Bulova requires unique skills not found elsewhere. The nature of these skills is such that a minimum training period of 3 to 5 years would be required. The operations involve know-how and judgment, as well as digital dexterity.

Toolmaking, whether it be the making of cutting tools such as drills, taps, or dies, or whether it be the making of special machines or gages, involves working with parts so small as to present very special problems. These are of two sorts—those arising from the delicacy of the parts, and those arising from the problems associated with working with very small dimensions.

Even a casual examination of watch parts—particularly such critical items as the pallet, escape wheel, balance wheel, and hairspring—reveals the essentially delicate characteristics of these parts. Machinery which manipulates these parts cannot employ separating, feeding, holding, and cutting devices common to similar machinery dealing with larger parts.

In an industry such as the automotive industry it requires 4 years' apprenticeship before a trainee becomes a toolmaker, and thereafter many years of experience before he is fully qualified to undertake independent work on complicated tools. But few toolmakers or diemakers can ever become watch-part tool or diemakers because of the additional requirements of working with very small dimensions. The largest part in a five-ligne watch is smaller than a dime, and dimensions are commonly stated in hundredths of a millimeter (four ten-thousandths of an inch). Watch tolerances (tolerance is the permissible variation in the dimension of a series of parts intended to be identical) are commonly a quarter or a half a hundredth of a millimeter—and may be as low as 18 one-millionths of an inch.

It takes years of additional training before an ordinary toolmaker can make watch part tools, without the direction of a more experienced tool designer. It also requires a rare adaptability, both mentally and physically, to this subminiature work.

3. *Inspection.*—Inspectors in a watch factory are charged with maintaining quality of the finished parts by holding them to the established standards of dimensions and surface finish. Inspectors may work within a parts producing department, or in a separate department.

To aid in measurement, for example, a number of special magnifying tools are provided, in which the shape and size of the finished part may be compared optically with a master profile. Not only must the inspector be able to handle the parts with loupe and tweezer, and work the measuring machines, but he must exercise judgment as to conformance of the part to the standard. Still greater skill is involved in judging the quality of surface finish of the parts, which may be as fine as 1 to 2 microinches; a microinch is a measure, in millionths of an inch, of surface roughness.

Only by experience can a worker become a skilled inspector. His exercise of judgment could not reasonably be mechanized.

II

Secondly, we conclude that the skills which I have just described—namely, the skills of the production workers requiring more than 2 years' training, combined with the skills of the engineers, toolmakers, machine setters, and supervisors—are unique to the watch industry.

(*a*) Even a casual examination of the watch parts which I now show you demonstrates the smallness and delicacy of watch parts. The manufacture of such parts requires skills of a totally different order of magnitude from the corresponding skills in industries dealing with ordinary sized parts. For example, I have here an average sized drill taken from our machine shop; it is capable of producing a hole to within five one-thousands of an inch of its nominal diameter. I have here a reamer which is used to enlarge slightly a drilled hole and to achieve a desired diameter within one one-thousandth of an inch (fig. 2).

Contrast these, if you will, with a drill and reamer used in the watch industry to produce the guard pinhole in the pallet. This drill produces a hole five one-thousandths of an inch in diameter and the reamer which I now hold in the tweezers (the part above the tweezers, not the part below the tweezers which is the shank or handle) refines the diameter of the hole to a tolerance of one ten-thousandth of an inch.

I have consulted the catalogs of the Browne & Sharpe and Taft-Pierce Cos.—both well known in the field of drills and taps. The smallest commercial sized drills listed are No. 80, which is thirteen and one-half thousandths of an inch in diameter, nearly three times as big as the tiny Bulova drill.

As another example, here is a half inch tap, used to cut threads in a hole to receive this half inch bolt. The smallest tap listed in the commercial catalogs is this one, a No. 0–80 which is sixty one-thousandths of an inch in diameter. On the other hand, I have here the drill and tap used in making the balance wheel in a watch and the screw which goes in that hole. The contrast is obvious. These watch screws are only twelve and one-half thousandths of an inch in diameter (fig. 3). The whole screw, head and all, would drop right through a hole drilled by the smallest commercial drill.

Turning from the machine tool industry to the electronic industry, I show you now a display of electronic components from a hearing aid amplifier. This is commonly considered to be an achievement in miniaturization and close packing of components, but again I point to the contrast with the watch parts and their density of packing.

It seems obvious that one does not move watch parts from spot to spot in a factory with a chain conveyor or drop chutes. A day's supply of certain parts is carried in an 8-ounce glass jar. The jar is covered because a careless sneeze could irretrievably scatter a thousand parts. Here are a thousand screws—part 55C. To pick one up you use a tweezer like this—sharpened to a needlelike point (fig. 3).

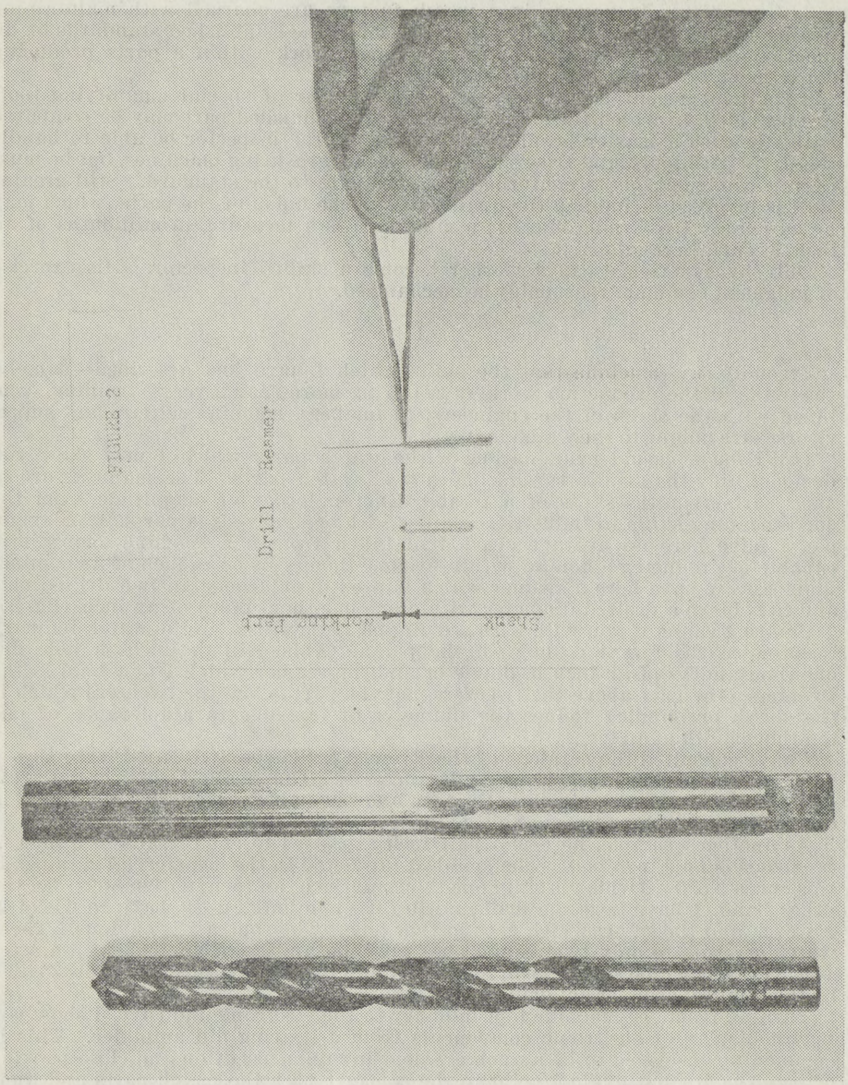

FIGURE 2

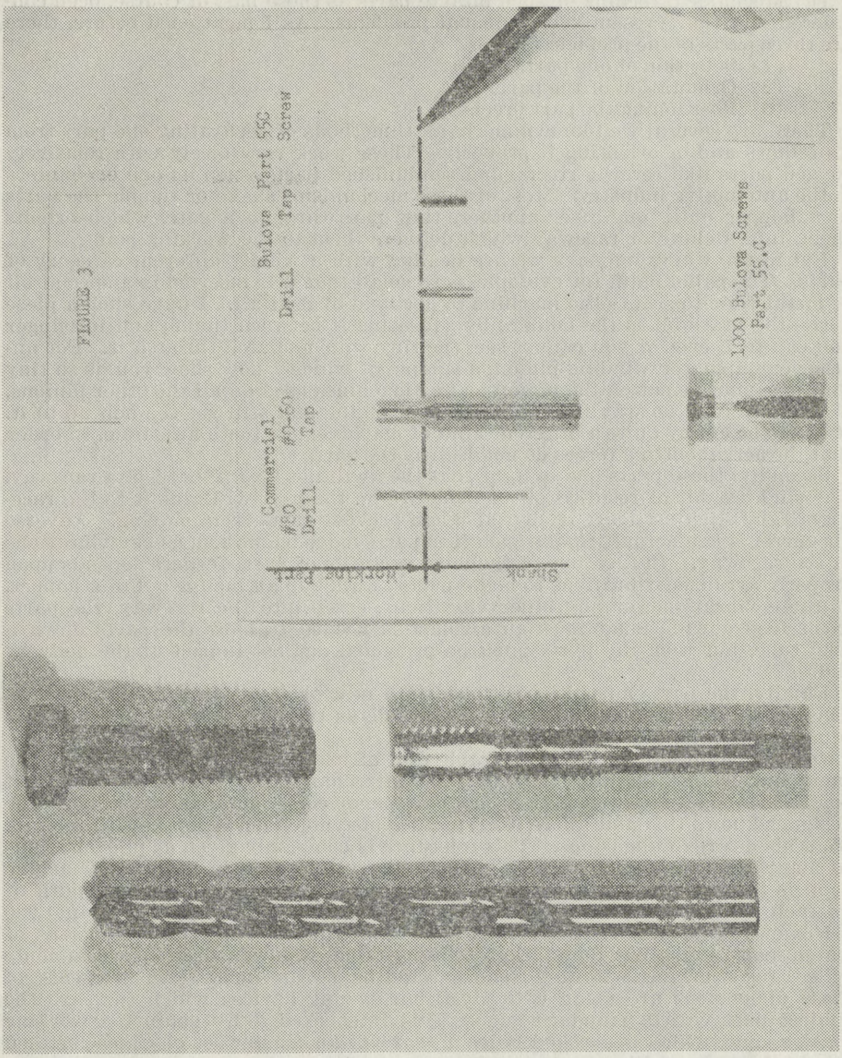
FIGURE 3
Bulova Part 55C
Drill Tap Screw
Commercial
#80 #0-80
Drill Tap
Working Part
Shank
1000 Bulova Screws
Part 55,C

Even this introduces a hazard of damage. The hairspring in a five-ligne watch is a round-edged strip of steel three one-thousandths of an inch wide and six ten-thousandths of an inch thick and about 5 inches long; a sample of which I have here. I trust you can see it. These pieces are picked up by a girl and placed in a device which winds the hairspring. The least tweak with the tweezers will kink the delicate wire so that it will never make a good hairspring. It takes 3 years' experience before an operator becomes skillful enough to make more good hairsprings than bad ones.

(*b*) Mechanical feeding of such minute parts as these has, of course, been considered, but they present some unusual problems. As I mentioned before, there are three parts to the problem:

(1) Selection of one part,
(2) Orientation of the part,
(3) Positioning the part precisely.

There are several well-known mechanical methods of separating one part from its fellows and of orienting it properly. These work very nicely with relatively rugged parts like screws, rivets, and semifinished parts, such as one encounters in the automotive industry. Most of these mechanisms shake or tumble the parts in a hopper until, one after another, they pass through a gate, which orients them, into a chute or raceway which delivers them to the working point.

But in the watch industry we are dealing with a wholly different category of parts. The pallet staff, for example, is so small that it is inserted in a special bit of metal which permits the machine to get hold of it at all. I have such a piece here—the brass bit is the holder; by squeezing it between thumb and forefinger you can feel, even if you cannot see, the tiny staff mounted through it. For another example, the winding pinion, a sample of which I now show you, is so tiny that it cannot be cut on the pinion leafing machines used on all the other pinions, because there is no way to hold it in the machine and still get the hob up to it. It has to be cut by quite a different kind of machine, one tooth at a time, in order that the actual cutting forces do not destroy the part.

Secondly, these parts are so light that they will not "work" well in a raceway. The slightest bit of residual oil or moisture on the part will glue it to the raceway. The slightest trace of dirt also can prevent parts from moving. Adverse air currents can actually make such tiny parts move backward, as can vibrations in the raceway. In fact, one of the most versatile of parts feeders depends upon properly arranged vibrations to make parts "walk" up an incline out of a hopper. If these vibrations, or any other vibrations, creep into the raceway, the parts won't feed down. Sometimes an airblast is needed to blow the parts down a feed tube, but then the parts must be protected against impact at the delivery end.

Finally, the parts must be positioned in a nest or cavity in a holding fixture. This, of course, is of the same size magnitude as the part it holds, and presents equally difficult building problems.

(*c*) In manufacturing, it is desirable that all parts of a given design have the same dimensions, so that they may be interchangeable. However, it is not possible to do this in practice; no two parts come out exactly alike. The designer knows this and, therefore, specifies how much deviation he will tolerate from his desired dimensions. This tolerance is commonly given as plus or minus so many thousandths of an inch. An ordinary tolerance in the usual machine shop is 5 one-thousandths of an inch, but with care one-half a thousandth of an inch can be achieved. Relative to a half-inch hole, this is 1 part in 1,000

However, consider what it means to achieve this accuracy on dimensions of watch part size. We found that tolerances on Bulova's drawings commonly called for working within 1 ten-thousandths of an inch. Measurements of these dimensions are made with electronic gaging devices which compare the subject part with a standard gage. This is checked daily against a working master gage, which is checked twice a year with a master set of gages certified by the Bureau of Standards. Bulova has such a set of standard plug gages beginning at 28 ten-thousandths of an inch in diameter and working up by steps of 1 ten-thousandths of an inch to one-eighth of an inch. Furthermore, these gages are hardened steel, whereas the smallest available commercial gages, made by the Van Keuren Co. of Watertown, Mass., are 5 one-thousandths of an inch in diameter and are soft steel. I know of nowhere else outside the watch industry where a set of such small, hard gages could be found. This means that exceptional skills and most unusual equipment is required to perform measurements of dimension to such accuracy.

(*d*) The manufacture of watch parts, combining as it does the handling of very delicate parts, the small dimensions and still smaller tolerances, the requirements of mass production, is unique. Only a few other branches of industry even approach these three characteristics, and then only partially.

The optical industry, which produces lenses and mirrors comes immediately to mind. Optical parts have very close tolerances indeed; everyone knows that the final shaping of a lens, for example, produces a predetermined curvature within very close tolerance. If this were not so, the image produced would be distorted. But lenses are large compared to watch parts.

The instrument builders have also been suggested. "Instruments" covers a huge and diverse field, but, of course, only those which embody mechanisms are even similar to a watch. Such instruments' elements might include the microscopes, tensile testing machines, laboratory balances, transits, telescope mountings, spectrometers, mechanical analog computers, ruling engines, and the like. While all of these are made to very close tolerances, most of them are gross compared to watch works and none of them could be said to be mass produced.

Vacuum tubes have delicate parts and are made in large quantities, particularly in the "miniature" size class, but they are not machines in the sense of having moving parts. The same applies to diodes and transistors. The rest of the electronic components are gross and made to coarse mechanical tolerances as compared to watch parts. The most densely packed electronic equipment of which I am aware is the "handy-talkie" radio set, which boasts a density of 26,000 components per cubic foot. A lady's five-ligne wristwatch has a component density of 5,600,000 parts per cubic foot.

It is safe to say that watches are a unique product of unique skills.

(*e*) There are very few watch movement designers in the country—Bulova has but one—and they are classed in the executive echelons and thus do not show in the classification of horological skills. However, their unique skills are probably among the rarest and most perishable of all skills. Beginning with a college degree in engineering physics, some 20 years of experience would be needed to meet all the problems of watch design. In these men is accumulated all the cumulative experience of the entire watch design field. The knowledge which makes the difference between excellent and indifferent watches comes slowly and painfully, and only as the result of years of experience with watch performance.

(*f*) We have been speaking heretofore of the skills of members of the watchmaking team. May I speak now about the team as a whole? We believe the skill of the watch industry team exceeds that of the sum of the skills of its members.

The production team at Bulova consists of watch movement designers, research engineers, production engineers, tool designers and toolmakers, group leaders, machine setters, and machine operators. These people all aid and assist one another, lending mutual support. None of them could work without the others. There is a vertical integration of the team, from research engineer to machine operator, as well as a horizontal integration from raw materials through the fabrication of the watch clear to final inspection and shipment.

Every part of a watch involves in its design and production the efforts of people with many skills. Take for example a gear wheel: The design engineer selects the tooth form for the gear teeth on the basis of long experience on the reliability of watches using various gear tooth forms. The designer, the metallurgist, and the methods engineer agree between them, for example, on the thickness of the gear. This is a compromise between the desire for a thin watch, and therefore, thin parts, and the difficulty of maintaining flatness in very thin parts when they go through the various forming processes. The methods engineer, the toolmakers and diemakers, and the production people have to agree on what machines will be used to cut the teeth so that the right amount of metal will be left on the gear blank by the die which formed it to allow for the final shaping of the teeth. Finally, the supervisors and operators must cooperate to achieve desired production rates while maintaining the necessary quality. This, in turn, involves the knowledge of the inspection experts to design and build adequate gages.

This pattern is repeated, with minor variations, on every part of the watch. The same cooperative efforts can equally well be applied to development of small accurate mechanisms other than watches. It is inconceivable to us to suggest that a portion of this smoothly working, closely knit team could be detached and kept active in vacuo, as it were, while the rest of the team is disbanded.

III

Thirdly, we conclude that the watch industry skills, as represented by the Bulova Watch Co., are of value to the national defense, and will undoubtedly continue to be of value.

(*a*) I refer you to testimony given by others, both to this hearing and to previous hearings on similar subjects, describing the work of the watch industry for the defense effort.

(*b*) It can be anticipated that there will be an increasing demand by the Armed Forces for smaller and lighter military instruments. Navigation, communication, and combat instruments, servomechanisms, and other control elements are being added constantly to aircraft, submarines, surface craft, and missiles. Space is at a premium, and frequently weight carries a penalty. Weight is also objectionable in portable equipment for land troops.

An example of this trend in miniaturization is the gyroscope. Once a bulky and heavy instrument, we are now familiar with gyroscopes no bigger than my thumb, and weighing but a few ounces. The further this trend is carried, the greater will be the demand for the skills of the watch industry when mass production of these delicate, small mechanisms is called for.

The flight of rockets, ballistic missiles, and earth satellites involve measurement of time, space, and velocity of an order of magnitude of refinement new to warfare. Space and weight in such weapons are at an even greater premium than in manned craft; and without pilots to exercise judgment, more and more complicated robots must be added to control the flight. To equip such weapons, we believe that there would be a greater demand for the watch industry skills in the future than in the past.

Fourth, we concluded that the technique of automation, when applied to the production of these and similar defense items which we can now foresee, would not eliminate the value of the key horological industry skills already described. For to mechanize further now would tend to freeze the product and the production line to today's watches or weapons, and one cannot mechanize now the production of watches or weapons as yet not developed.

(*a*) The history of the past 16 years must be convincing evidence that weapons are constantly evolving. We are told repeatedly that our potential opponents are increasing the pace as well as the quality of their developments. We cannot afford to freeze upon obsolescent weapons in order to have time to automate the production process. Nor can we afford the luxury of automating the production line of every successive weapon design, and then junking the machinery and the engineering talent it absorbed when the next design appeared.

(*b*) Furthermore, production techniques and materials are also evolving, just as are weapons. It would be just as unwise to commit ourselves to obsolescent mechanized facilities as to obsolescent weapons. And it is patently impossible to design automatic production equipment for watches or weapons not yet designed.

(*c*) Let us also take a realistic look at the time, cost, and skills involved in automation itself. May I reiterate what I said before: The time required to conceive, design, build, test, and activate a fully automatic line precludes getting useful production within the first year, or even two, from the time the product is frozen. In wartime this is far too long a delay. The process cannot be accelerated beyond a certain amount. And the corresponding cost would be tremendous. I suppose that in wartime no one counts the cost in dollars. But the cost in effort of the few engineers who can do such work must be counted, particularly so because they will be in tremendous demand from all the rest of industry at the same time.

The technique of automation demands the services of highly trained engineers and economists, skilled machine designers, and machine tool builders. There are at present three limiting factors which control the speed with which mechanization can enter industry, and one of them is the short supply of competent engineers and machinists. The well-recognized dearth of engineers today is in large part due to the high demand for their services in portions of industry which rarely called upon them in the past, as well as the demand of Government-sponsored research and weapons development.

The automation program implied by the proposal that skilled labor in the watch industry be supplanted by automatic machinery is unreasonably, and in my opinion, hopelessly large. While nothing is totally impossible, such a program is most impractical. We do not believe that Bulova could detach enough engineers and toolmakers from their present tasks to make a dent in such a program. We doubt that enough competent watch toolmakers exist to implement such a program, even if an adequate number of competent engineers could be found.

V

Finally, we are convinced that a team in industry such as that of the watch industry must be kept together and at work or its skills will atrophy.

(*a*) It is economically unreasonable to lock the door on a plant like Bulova's for an indefinite period, and then expect to open it up and have it workable. Idle machine tools are a straight economic loss, and tend to be dispersed to productive use elsewhere. Similarly idle buildings are economic losses, and the tendency is to divert them to some productive use. Even presuming that the buildings and equipment could be forcibly retained, it would be no mean feat to preserve it from physical deterioration due to the passage of time.

(*b*) But, even if the Government were willing to undertake this vast expense, the skilled workers and the team as a whole would be lost. One cannot put people into mothballs. Therefore, when and if the plant were to be reactivated, the workers would have to be recalled or replaced.

However, a disbanded team can never be fully recovered, unless a condition of labor conscription should exist. Even so, there is a continual loss of know-how and skill due to death and dispersal of a dismissed working force. With an active working force, recruitment and apprenticeship replace normal attrition, but with a dispersed force, there is no replacement.

Of course, some workers could be recovered even years later, but unused skills deteriorate rapidly, as witness your golf game over the winter months. While retraining may not take as long as original training, it would have to be done.

It is difficult enough to recruit and train watchworkers even in peacetime. Out of 40 applicants to Bulova, only 10 are accepted for training, and 4 of these survive the basic training period. One of these four leaves within 3 months, because he or she does not have the temperament necessary for a good watchworker—emotional stability, patience, and great powers of concentration. Thus to acquire the 829 workers involved in domestic watchmaking at Bulova,[5] over 11,000 applicants must have been screened.

To offset the normal attrition of a working force due to death, retirement, etc., it is necessary to maintain an inflow of new workers, who must be trained in an apprentice program. Such a training program can only be conducted in an active factory, where skilled workers can teach the skills by actual watchmaking. In the absence of a healthy operating industry, such a training program would be impracticable, lacking both in means and morale.

I have said that there is a skill to the team as a whole which is separate from and exists in addition to the skills of the individuals. That skill is, of course, lost forever when the team is disbanded. Like the hydrogen in a pricked balloon, it is irretrievably lost and can never be recovered.

To summarize:

After careful study of Bulova, ADL found:

1. There are workers in the watch industry, as exemplified by Bulova, whose skills are not likely to be replaced by machinery in the foreseeable future.
2. These skills are unique to the watch industry. They comprise the skills of handling very small, very delicate parts in mass production.
3. These skills are of value to the national defense.
4. The techniques of automation, when applied to the production of the defense items which we can now foresee, would not eliminate the value of the watch industry skills.
5. An industrial team, such as that at Bulova, must be kept together and at work or its skills will atrophy.

Appendix A–1

Arthur D. Little, Inc., is a consulting industrial research and engineering organization, established in 1886 and now one of the oldest, largest, and most diversified of today's technical consulting companies. It is incorporated as a business organization in the Commonwealth of Massachusetts.

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[5] June 1956.

It offers research and development services in virtually all fields of applied science and engineering. It offers services to management, such as market and business research, plant location, diversification and growth studies, technical economics, product and industry studies, operations research, investment services. It designs, develops, constructs, and services specialized equipment for use by the research scientist. It develops new products and the new techniques and equipment for their manufacture.

The objective of ADL is to combine scientific methods, technological skills, and sound business judgments to the profitable solution of its client's problems. Today, its staff numbers about 900 individuals, approximately 60 percent of whom are graduate scientists, engineers, economists, and mathematicians. The experience and the varieties of professional training of its staff provide a uniquely comprehensive approach to industrial problems.

Appendix A–2

Qualifications and Experience

Mr. Allen Latham, Jr.

Mr. Allen Latham, Jr., vice president in charge of our mechanical engineering division, was trained as a mechanical engineer at Massachusetts Institute of Technology and acquired 5 years' experience in process development work at the ammonia division of E. I. du Pont de Nemours & Co., followed by an additional 5 years' experience in equipment development, production, and management problems at the Polaroid Corp., prior to joining Arthur D. Little, Inc. Between the periods at Du Pont and Polaroid, he augmented his engineering training with a year of graduate work at Massachusetts Institute of Technology in business and engineering administration. While at Arthur D. Little, Inc., Mr. Latham has worked intensively on such problems as the development of portable vapor compression distillation equipment for extracting fresh water from sea water, refinement of the ADL Collins Helium Cryostat, and a wide variety of industrial problems extending from development of special quality control instruments to design and fabrication of unique research and manufacturing equipment.

Dr. Joseph Harrington, Jr.

Dr. Harrington, a senior member of our staff, received his B.S. and Sc. D. degrees in mechanical engineering from Massachusetts Institute of Technology. His background includes 23 years' experience in industrial research with the United Shoe Machinery Corp. of Boston, Mass. Part of this time, he acted in the capacity of assistant director of research. Among his activities were the design of automatic machinery for the manufacture of shoes and leather products; development and design of automatic weapons and fire control apparatus; market analysis, product policy, research programing, and product diversification.

Since he joined our staff in 1955, he has worked on a variety of problems and has been in charge of the mechanical design and development group within the mechanical engineering division. The projects handled by him and his group include original design and development of new mechanical equipment, the design of mechanical products and the necessary manufacturing machinery, the automation of manufacturing assembling and testing processes, and consultation with client's management on mechanical subjects.

Dr. Frank W. Maurer

Dr. Maurer received his B.A. degree from Antioch College, attended the University of Pittsburgh and the University of Michigan Medical School. He was awarded the Ph. D. in medical physiology from the University of Rochester Graduate School. He has had experience in basic research as well as in the development of research equipment and laboratory instruments. As one of his teaching and research assignments, he was assistant professor at the Harvard School of Public Health where, in addition to research and teaching, he served as a consultant to several industrial concerns. During World War II, he was a member of the section on high altitude military breathing equipment of the National Defense Research Committee. He also served as a committee member of the National Research Council and the National Advisory Council. As a consultant on both medical and industrial problems, he served the Hercules Powder Co., the Polaroid Corp., the Willson Products Co., and the Office of the Quartermaster General.

Prior to his association with Arthur D. Little, Inc., he was active in the design, development, and manufacture of consumer goods, the development of experimental machinery, the manufacture of flexible abrasive materials and in private consulting. He has been the author of a number of published scientific papers and is listed in "American Men of Science" and "Who's Who in American Education."

Mr. Philip Donham

Mr. Philip Donham, a senior staff associate, has had considerable training and experience in management problems. After completing his course in geology for a B.A. degree at Harvard, he continued his studies at the Harvard Business School in the finance field and later received a D.C.S. in financial management. After a year's training in nearly all departments of the First National Bank of Boston, he did credit work on overdue loans, both industrial and personal. From there, he went to the Nashua Gummed & Coated Paper Co., where his experience included factory, sales, and distribution cost accounting and control, as well as aid in the solution of complicated pricing problems. During the war years, he was an active member of top management team of Electro Refractories & Abrasives Co., participating in all policy decisions and having primary responsibility for long-range planning. While with Booz, Allen & Hamilton of New York City, he developed a considerable background in top management and organization planning through consulting work for more than 60 clients in both industrial and institutional fields.

Mr. Donham served as one of our consultants in management services, and has recently joined the staff of Arthur D. Little, Inc., where he is associated with the management and business services division.

Appendix B

Barrel	Winding pinion	Roller
Barrel cover	Setting lever	Hairspring
Barrel arbor	Yoke	Minute hand
Center wheel pinion	Setting wheel	Hour hand
Third wheel pinion	Regulator	Second hand
Fourth wheel pinion	Lower jewel plate	Dial
Hour wheel	Mainspring	Top jewel plate
Minute wheel pinion	Balance wheel	Pillar plate
Canon pinion	Balance staff	Barrel bridge
Escape wheel pinion	Pallet	Train bridge
Ratchet wheel	Pallet staff	Pallet bridge
Crown wheel	Escape wheel	Balance bridge
Clutch wheel		

Appendix C

Watchmaking

Completely or partially assembled watches which depart from standards must be inspected, disassembled, and tested in order to diagnose the difficulty or defect. The person doing so must be able to perform all the assembly and adjustment functions, and also know the parts manufacturing procedure so as to perceive the true source of the difficulty and call for its correction. Frequently samples from a lot of new parts—e.g., hairsprings—are assembled into watches and tested in operation as a working part of the whole, to determine the ultimate acceptability of the lot of parts.

Hairspring truing

After the hairspring has been attached to the balance wheel staff by the colletting operation, it must be positioned so that its inner coil is concentric with and at the right radius from the collett, and the plane of the spring is perpendicular to the balance staff.

The operation is performed by tweezers and requires a high degree of judgment in the point and direction in which force is applied to the delicate spring to bend it to shape.

Hairspring vibrating

This operation is the one which determines the correct length of the whole hairspring by estimating the length and comparing the resultant speed of vibration with the standard speed.

Hairspring winding

Hairspring wire in the soft condition is cut to length and then manually positioned in a winding fixture and, with four or five other similar wires are wound, simultaneously, concentrically around a winding arbor and inside a drum-shaped retainer. The slightest kink or twist in the soft wire will make a defective spring and will also spoil the others in the drum.

Balance wheel poising

The balance wheel, the balance wheel screws, and the balance wheel staff are assembled and mounted in jeweled bearings. The screws in the rim of the wheel are inserted to add mass to the wheel, but if the assembly is not perfectly balanced, it will not function. Therefore, its balance in the bearings is observed, and tiny bits of metal are machined from the screwheads until the whole assembly is in perfect balance. The location and amount of metal to be removed is a matter of judgment based on long training and experience.

Pallet stone setting

There are two stones in a pallet, each held in a slot at the end of an arm on the pallet. The stones are first "fitted" in place; this means selecting a stone, closing the slot so that stone will be a tight fit, and pushing it into approximately the right place selected by eye. Then the stones are "set" by placing the assembly in a very sensitive measuring instrument and moving the stones in or out until they are in the correct position. The amount of force to apply and the distance to move them is a matter of skill and judgment. The jewel is then fastened with a tiny bit of shellac.

Setting, which requires a high degree of skill, is part of the job done by workers classified as "pallet stone fitters" at Bulova. Certain holding fixtures and gages are provided for this operation and, we are informed, other manufacturers using such devices describe the setting as a machine operation. Bulova, however, as a matter of good and economic manufacturing practice achieves by its procedure a final placement of the stones by the skill of the operators. No subsequent adjustment of the stones is made after the watch is assembled.

Roller jewel setting

The roller jewel is a D-shaped jewel mounted in the balance wheel assembly. It is mounted in a manner similar to the pallet stones. The operation requires a little less judgment and a little more skill than the pallet stone operation.

Watch parts inspecting

Throughout the manufacturing operations which shape the parts of a watch, a constant surveillance of the process is maintained to make sure that the parts are of the right shape and size. If they were not, the watch could not be assembled. Inspection involves not only the skill of operation of precision-measuring instruments, but the knowledge of what to do with the knowledge gained by the measurements. Only a few possess the rare mental quirk necessary to be a good inspector.

Guard pin adjuster

The guard pin is a tiny wire inserted in the pallet in such a manner that the pallet cannot move until the balance wheel roller jewel has swung around opposite the slot in the pallet. The guard pin must be cut to just the right lengh and then bent so that it is perfecly alined with the center of the slot.

This is one portion of the overall task of adjusting the time-measuring parts of the watch so they will keep correct time.

Banking pin adjusting

The banking pins are two tiny wires set in the pillar plate near the pallet in such a manner as to limit the swing of the pallet. After they are inserted and the timekeeping train (balance wheel, pallet, and escapement wheel) has been assembled, the banking pins are bent to just the right position, and filed to just the right length.

This is another portion in the overall task of adjusting the time-measuring parts of the watch so it will keep the correct time.

Setting up

Machine tools, such as automatic screw machines, are generalized instruments capable of producing a wide variety of parts. To produce a batch of parts it is first necessary to decide upon the sequence of operations; to procure the necessary tool bits, drills, taps, saws, etc. in sharp condition; to place them in the toolholders in just the right positions; to program the machine controls to achieve the correct sequence, speed, and extent of tool motion; to load the machine with raw stock; and to check the parts produced for size and shape. These tasks are called "setting up." They require a knowledge of the metal-cutting art, plus the manual dexterity necessary to place the tools so as to produce precisely what is desired.

The Essentiality to National Security of the American Jeweled Watch Industry

A report to the Director of the Office of Defense Mobilization by the Interdepartmental Committee on the Jeweled Watch Industry, June 30, 1954

MEMBERSHIP OF THE COMMITTEE

Chairman: Office of Defense Mobilization.
Members:
- Department of State.
- Department of the Treasury.
- Department of Defense.
- Department of Commerce.
- Department of Labor.

I. INTRODUCTION

The problem

The ability of the United States to deter or to resist aggression rests in large part upon its industrial resources. During the last several years the Government has provided various kinds of financial assistance in order to encourage the building of an industrial base from which a rapid expansion could be initiated in event of war to supply our Armed Forces, our allies, and our defense supporting and essential civilian requirements.

Equally as important as the creation of this mobilization base is its maintenance and preservation. In some cases this has been done by stockpiling, by maintaining standby plants, or by continuing limited defense production within the limits of the mobilization reserve, in order to maintain a nucleus of management, workers, and facilities in operation.

During World War II, the American jeweled-watch industry was a very important part of our industrial mobilization base. It supplied almost all our military requirements for jeweled-watch movements, including essential supplies to our allies, and produced, at the same time, a great variety of high precision mechanisms for military weapons.

Beginning in 1952, the industry showed a sharp decline in the manufacture of jeweled-watch movements. The President ordered, in that year, a study of the industry to determine whether loss and deterioration of highly developed watchmaking skills were likely to imperil the security of the United States in the event of national emergency. The National Security Resources Board conducted the study and concluded that production and employment in the industry were still sufficiently high to maintain the base of skills necessary to the national defense.

However, there were further indications in mid-1953 that production and employment levels in the industry might decline to a point that would endanger the defense mobilization base. Consequently, the present Interdepartmental Committee on the Jeweled Watch Industry was established.

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The committee was directed to conduct a further study and report its findings and recommendations to the Director of the Office of Defense Mobilization with regard to the following problems:

1. *Is preservation of the skills of the American jeweled-watch industry essential to the national security?*

2. *Are production and employment in the industry at such levels as seriously to threaten preservation of those skills?*

3. *In the event preservation of essential skills is threatened, what measures, if any, might be taken by the Government to alleviate or solve the problem?*

Limitations of the study

In the course of this study, some consideration has been given to other segments of the American horological industry and to other firms which produce items such as fuses, also produced by the jeweled-watch manufacturers. Attention was focused upon jeweled-watch production for two reasons: (1) The problems affecting this segment of the industry appeared most acute and most immediate, and (2) it was desired to limit the study to manageable proportions and to develop techniques which later could be applied to the evaluation of the mobilization base requirements of other industries essential to national defense.

Accordingly, limitation of this study to jeweled-watch manufacture should be construed to imply that other segments of the horological industry are necessarily any less essential to national security.

The National Security Resources Board study

Following the 1952 tariff hearings on the watch industry, the President directed that a study be made of the problem of maintaining essential manpower skills in the watchmaking industry. As requested by the President, the Chairman of the National Security Resources Board appointed an interdepartmental committee which submitted a report to the President (classified confidential), on January 8, 1953. The NSRB report has been carefully reviewed and some of its findings have been incorporated in the present study.

The following significant findings were made by the NSRB Committee:

1. Precision jeweled movements are essential to national security in wartime;

2. These movements are uniquely produced in the United States by the firms in the American jeweled-watch industry;

3. The mobilization base cannot be preserved by use of standby facilities because of the nature of skills involved and the long training time required which make it necessary to keep workers actually producing products using these skills;

4. Skill attrition is not a serious problem in the short run when workers are temporarily transferred to less exacting work in the same plant, but if prolonged, such transfer results in loss of skill, workers leaving the plant, and cessation of training.

The NSRB committee concluded that (1) a minimum number of jeweled movements should be continuously produced by this industry in order to preserve an expandable base of skilled workers; (2) a minimum production range specified by the committee was currently below actual production; and (3) in view of current levels of production and employment no action by the Government was warranted at that time.

Procedure of the present study

In July 1953, the present Interdepartmental Committee on the Jeweled Watch Industry was established, chaired by the Office of Defense Mobilization, and consisting of representatives of the Department of Defense, Department of Commerce, and Department of Labor. The Treasury Department was subsequently brought into the committee for the limited purpose of contributing its point of view on the tax and customs aspects of the possible means of assistance to the industry. The Department of State's participation was invited only for the purpose of assisting the committee on those aspects of the report which involved foreign economic policy questions.

This committee reveiwed the work of the earlier committee and determined that existing estimates of mobilization requirements for products manufactured by the jeweled-watch industry were totally inadequate upon which to base an appraisal of the essentiality of the industry to national defense. Accordingly, the Department of Defense undertook an exhaustive study of military requirements during a 3-year mobilization period involving not only jeweled movement requirements, but also requirements for ammunition timing mechanisms and the interrelationship of subcontracting and parts production for other manufacturers of military equipment. This was one of the most complete studies made of end item full mobilization requirements for a single industry.

The Commerce Department conducted an analysis of defense-supporting and essential civilian requirements during full mobilization, and provided background information relating to industry production, problems of the individual firms, and the business outlook for precision jeweled watches.

The Labor Department surveyed the industry to obtain revised employment and skill data, supplementing its earlier technical and field studies.

Informal hearings were held by the committee to obtain the views of all of the groups concerned with this problem. Discussions were had with the four domestic producers and the vice president of the American Watch Manufacturers Association; two importers, including the president of the American Watch Association; the president of the Clock Manufacturers Association of America which represents 14 companies in the clock and nonjeweled watch field; three nonhorological firms engaged in the fuze program; and the president of the American Watch Workers Union. (See app. A for list of firms and organizations). In addition, briefs and other data were received from many of these and some other firms.

The findings and recommendations of the Committee are based on the security need to retain an essential skill base primarily for the production of the unique products of this industry and secondarily for the production of other products of which this industry would be an important supplier in the event of full mobilization. The public interest in preserving to the maximum possible extent the industry's freedom of action to solve its problems through its own initiative, free from dependence upon Government, guided the Committee's deliberations.

II. THE NATURE AND SITUATION OF THE INDUSTRY

Background

The domestic jeweled watch manufacturing facilities constitute a small and highly specialized industry composed of four companies: the Bulova Watch Co., the Elgin National Watch Co., the Hamilton Watch Co., and the Waltham Watch Co.[1] According to War Production Board statistics, the 1940–41 employment level of this industry averaged about 8,000 workers, and reached an average of approximately 12,000 in the peak year of World War II. Current employment levels are about 9,500 workers, less than half of which are engaged in the manufacture of jeweled watches.

These companies have no counterpart in American industry. Other manufacturing plants frequently work to tolerances as close as the jeweled watch manufacturers but seldom apply these tolerances to such minute parts on a continual mass production basis. The highly specialized skills of this industry cannot be considered as interchangeable with any other industry.

The domestic jeweled watch industry represents the only significant manufacturing facility for production of jeweled watches outside of Switzerland. The Swiss industry supplies over 90 percent of the world market and about 85 percent of the U.S. market for jeweled watches. Although France, Germany, and Italy have small jeweled watch industries, they operate largely with Swiss-made components. Great Britain is currently attempting to rebuild her jeweled watch industry which was allowed to deteriorate prior to World War II.

During World War II the American jeweled watch industry was completely converted to military production with the exception of a few instances where small amounts of capacity had to be diverted to meet critical needs for essential civilian timepieces. During the war period the industry delivered to the Armed Forces 3.5 million timepieces, 4.2 million instruments other than timepieces, 22 million fuzes, and 7 million fuze components. It also produced more than 350 million precision parts for other prime contractors of critical military equip-

[1] The four companies, Bulova, Elgin, Hamilton, and Waltham, are the major domestic producers of precision jeweled watches with a potential annual capacity of 4 to 5 million watch movements and estimated production during 1954 of approximately 1.7 million movements. Although the Gruen Watch Co. reports that it has in recent years undertaken the manufacture of domestic jeweled movements, this production represents a nominal percentage of the company's total domestic and foreign watch business. Its manufacturing facilities at present are primarily devoted to defense work. Because the production facilities of this company are now so heavily engaged in other than watch production and its output of domestic precision jeweled movements is a minor fraction of the total domestic production as well as of its own watch business, it has been decided for purposes of this report not to include Gruen as a major domestic producer.

ment. Although the industry was expanded as rapidly as possible it was sorely pressed to meet the demands which were placed upon it.

Although the pressures during the Korean war were not as great, the contributions of the jeweled watch industry were highly significant. The facilities of the industry were repeatedly called upon to solve critical problems and break "bottlenecks" which occurred. During the Korean war, the industry produced over 19 million artillery and rocket fuzes on direct military contract, over 160 million fuze and instrument parts on subcontract to other producers, as well as many other small, precision mechanisms.

Trends in watch production

Although expansion of the market and technological improvements enabled the domestic production of jeweled movements to reach an all time high in the post-World War II period, it has been declining in the past several years. The following table shows the number of movements produced by domestic producers during selected periods:

Period or year	*Number of movements produced (in thousands of units)*
1926–30 average	1,835
1931–35 average	781
1936–40 average	1,678
1941–45 average	1,602
1946–50 average	2,475
1948	3,069
1949	2,717
1950	2,505
1951	3,040
1952	2,377
1953	2,365
1954 estimated	1,700

Source: Averages from U.S. Tariff Commission, years 1948–54 from U.S. Department of Commerce.

The period since 1926 has seen a shift first from pocket to wristwatches, then to smaller wristwatches, and progressively to higher jewel counts. The vast bulk of the sales of quality watches are today 17-jewel movements. Virtually no jeweled-lever watches with fewer than 17 jewels are now manufactured in the United States.

Since 1936 the relative cost relationships of the American producers vis-a-vis Swiss imports have been affected by changes in the cost of production without changes in the tariff. Before World War II, domestic movements could be produced at approximately the landed costs of imported movements, including duty; today it is estimated that the cost differential generally ranges from $3.50 to $4.25 in favor of imports.

As sales of jeweled watches have increased in the United States, the volume of imports and their share of the domestic market have progressively increased. Imports containing 16 or 17 jewels (virtually all have 17) rose from an average of 1.1 million units during 1936–40 to 5.6 million units during 1946–50, and to 8.3 million units in 1953.

Watch movements containing more than 17 jewels cost very little more to produce but bear a duty of $10.75. The result has been that very few of these have been imported; in recent years they have averaged about 5,000 units annually and have accounted for one-tenth of 1 percent or less of total imports. At the same time, the domestic producers have been progressively shifting more of their production to these movements. The proportion of watches produced domestically with more than 17 jewels has increased from 4 percent in 1934–35 to 42 percent in 1946–50, to about 50 percent today. All four of the domestic producers are currently importing part or all of their sales of 17-jewel movements. During 1953 the 4 domestic producers imported about 2 million 17-jewel movements which, together with the 2.3 million movements of 17 or more jewels produced, makes a total of 4.3 million watches handled by these companies.

As the domestic industry has cut back its production of jeweled watch movements, it has, until this year, handled a large and, until recently, increasing volume of defense work. In addition, some of the companies have begun to diversify their production so as to be less dependent upon jeweled watches. Although in total the four companies have been generally profitable during the past several years, they allege that their production of jeweled movements has dropped to the point at which such production is no longer profitable.

Watch production has declined sharply in the last 4 years. The companies involved have stated that their domestic production of jeweled movements is currently operating at or below the "break-even" point, and that they may be forced to suspend such production unless the Government determines the industry to be essential to national defense and provides assistance in creating an economic environment in which watches can be produced at a reasonable profit. While it does not appear likely that failure of the Government to take such action would result in an abrupt and immediate cessation of jeweled watch production in the United States, there is no substantial reason for doubting that production would continue to decline and that ultimately the industry might for all practical purposes discontinue domestic production of jeweled watch movements.

Trend in watchmaking employment

Employment in the jeweled watch industry in June 1954 was at its lowest level since 1950. The 4 companies employed approximately 9,600 workers, about one-sixth fewer than 9 months previously. The employment statistics collected by the Department of Labor show the extent to which watchmaking employment has declined in recent years while defense work has, until this year, sustained total employment (tables 1 and 2). In June 1954 nearly 57 percent of the industry's production worker man-hours were spent on the production of military products while only 43 percent were spent on civilian items (mainly jeweled watch movements). By comparison, 55 percent of production worker man-hours were devoted to civilian production in September 1953; 69 percent in 1952; and 89 percent in 1951. Man-hours spent on civilian production in June 1954 were only 28 percent of the 1948 level and only about half of the September 1953 level.

While the data show that the decrease in employment since September 1953 was in civilian items and that employment on military products had increased somewhat, termination of fuse contracts has resulted in some employment losses within the last few weeks. In at least two of the companies further substantial layoffs were expected as a result of these fuse contract terminations.

Since the emphasis of this investigation was on maintaining a supply base of key workers which might be needed to meet mobilization goals, information was obtained in the fall of 1953 on the employment of workers in a selected group [2] of key occupations to see what changes had occurred between September 1952 and September 1953 (table 3). For these occupations as a whole there was a decrease of about 5 percent in the 1-year period. There was about a 12-percent decline in the number of workers in these occupations employed in the production of civilian products. This was partly offset by an increase in the number of workers in these key occupations producing military items. The apparent conclusion is that some of these workers have moved over from civilian to military work.

TABLE 1.—*Employment and man-hours expended for defense and civilian production in the jeweled watch industry—1948–54*

Year [1]	Employment			Production worker man-hours expended on—					
	Total	Production workers	Women	Total		Defense items		Civilian items	
				Number	Percent	Number	Percent	Number	Percent
1948	12, 268	11, 028	6, 696	452, 908	100	557	0. 1	452, 331	99. 9
1949	10, 528	9, 334	5, 435	354, 577	100	3, 898	1. 1	350, 679	98. 9
1950	8, 613	7, 394	4, 220	287, 701	100	7, 152	2. 5	280, 549	97. 5
1951	10, 462	9, 079	5, 444	376, 720	100	43, 198	11. 4	333, 522	88. 6
1952	10, 557	9, 014	5, 383	354, 245	100	110, 343	31. 1	243, 902	68. 9
1953	11, 521	10, 172	6, 081	388, 517	100	173, 665	44. 7	214, 852	55. 3
1954	9, 624	7, 805	4, 889	289, 776	100	163, 936	56. 6	125, 840	43. 4

[1] Week ending nearest Sept. 15, for each year except 1954 which was for week ending June 12.

Source: Survey of Watch and Clock Companies, November 1952, October 1953, and June 1954.
Prepared by: Branch of Industry Studies, Division of Manpower and Employment Statistics, Bureau of Labor Statistics, U.S. Department of Labor, June 23, 1954.

[2] Occupations included in this group are job master, mechanical engineer, industrial engineer, watchmaker, watch adjuster, watch assembler, watch assembly inspector, machinist (horological), and tool and die maker.

TABLE 2.—*Percent distribution of production worker man-hours by defense and civilian production in the jeweled watch industry—1948–54* [1]

Product item	1954	1953	1952	1951	1950	1949	1948
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total defense items	56.6	44.7	31.1	11.4	2.5	1.1	.1
Military timepieces	5.2	3.6	4.9	2.2	1.3	.9	(2)
Time fuses	27.3	25.1	12.5	3.2			
Fuse components	21.8	12.3	7.4	3.5	.5		
Other military procurement items	2.3	3.7	6.3	2.5	.7	.2	.1
Total civilian items	43.4	55.3	68.9	88.6	97.5	98.9	99.9
Jeweled watch movements			66.2	85.4	94.4	96.1	96.7
Clock movements			.5	.5	.5	.4	.3
Other products and components			2.2	2.7	2.6	2.4	2.9

[1] For week ending nearest Sept. 15, for each year except 1954 which was for week ending June 12.
[2] Less than 0.05 percent.

Source: Survey of Watch and Clock Companies, November 1952, October 1953, and June 1954.
Prepared by Branch of Industry Studies, Division of Manpower and Employment Statistics, Bureau of Labor Statistics, U.S. Department of Labor, June 23, 1954.

TABLE 3.—*Distribution of workers in selected key occupations in the jeweled watch industry by type of product*

Occupation	Percentage of workers employed					
	1953			1952		
	All products	Civilian products	Military products	All products	Civilian products	Military products
Job master	2.5	2.8	2.1	2.6	3.0	2.1
Mechanical engineer	.6	.5	.7	.7	.4	1.3
Industrial engineer	.1	.1	.2	.2	.1	.2
Watchmaker (classes I–III)	1.0	1.5	.3	1.2	1.5	.4
Watch adjuster (classes I–II)	2.0	3.4	.3	2.3	3.2	.4
Watch assembler (class I)	1.7	2.6	.6	2.4	3.1	.7
Watch assembly inspector (class I)	1.0	1.7	.3	1.3	1.6	.4
Tool and die maker (classes I–IV)	2.7	2.4	3.0	2.6	2.4	3.2
Machinist (horological)	1.0	1.3	.5	1.1	1.0	1.4
Total—9 occupations	12.6	16.3	[1] 7.8	14.4	16.3	10.1

[1] Individual percentages do not add up to this total because of rounding.

Source: Survey of Watch and Clock Companies, November 1952 and October 1953.
Prepared by Branch of Industry Studies, Division of Manpower and Employment Statistics, Bureau of Labor Statistics, U.S. Department of Labor, Dec. 1, 1953.

When these key occupations were examined individually, considerable variation in the employment changes showed up. For example, the total number of job masters employed is about the same in the two periods; the increase of workers employed on military items almost exactly offset the decrease in the number making civilian products. The number of tool and die makers actually increased during the period, even though there was a 10-percent decline in employment on civilian products. However, the highly specialized watchmaking jobs, such as watchmaker, watch assembler, and water assembly inspector, showed a relatively large decrease (about 19 percent) on civilian production and did not show much of an offsetting increase in the production of military items.

One of the questions raised in this study was to what extent military contracts are contributing or will contribute to maintaining the supply base of keyworkers. In this connection it might be well to point out that the sample group of keyworkers makes up only about half as high a proportion of all workers in the production of military items as they do in the production of civilian items (7.8 percent compared with 16.3 percent). As can be seen in table 3, this group of skilled workers declined in importance from 14.4 percent of total employment in September 1952 to 12.6 percent of employment in September 1953. This decrease resulted because employment on military products increased sharply and total civilian employment declined substantially. Furthermore, as military production expanded, the proportion that this skill group made up of total military employment declined from 10.1 percent in September 1952 to 7.8 percent a year later.

Maintenance of the skill base

The available statistics do not give a full picture of the problems involved in hiring, training and retaining workers in the highly skilled categories. The high precision, close tolerances, and extremely small size of parts make many of these skills unique to this industry.

In the last decade the domestic industry generally has made considerable technological advancement in production methods. In Switzerland, movements are assembled by individual craftsmen due to the union prohibition on assembly line production. Assembly lines were introduced into the American industry in 1946. One company used to require 400 workers to assemble 1,200 watches per day; it now can assemble the same number with only 45 to 50 workers. However, reduction of assembly workers has, to some extent, increased the requirements for parts manufacturing workers due to the increased precision of components required for mass production assembly.

For all production workers, the gain in productivity has been less spectacular. As shown in the following tabulation, output per employee in 1953 was 39 percent higher than in the prewar period of 1936–40.

Average output of jeweled watch movements per employee, selected periods

Period	Output, jeweled watch movements (in thousands)	Average number of employees on watches and parts	Output per employee	Index (1963–40 =100)
Average, 1936–40	1,678	6,473	259	100
Average, 1941–45	1,602	7,572	212	82
Average, 1946–50	2,475	9,318	266	103
1951	3,162	8,847	357	138
1952	2,433	7,147	340	131
1953	2,365	6,588	359	139

Although existing skilled workers have tended to stay with the watch firms because of seniority, benefits, location, etc., in the event of layoffs they are readily hired by other precision industries and are very difficult to rehire for watch work. The long training times required for skilled watchmaking jobs makes the training of replacements a slow and difficult process.

Along with the progressive decline in skilled workers there has been an increase in the percentage of older workers, which accentuates the danger of further depletion of working skills with the passage of time. Under normal conditions there is a constant process of recruiting and training younger workers so that they will be available to fill the gap caused by the retirement or death of elderly workers. Because of the recent relative decline in watch production compared with the expansion of American industry generally, it has become more difficult to recruit younger workers and less training has been conducted by the industry. Consequently, the reserve of skilled workers has become increasingly small.

The nature of the skills and the long training time required for key skills in producing jeweled watch movements make it necessary to keep workers directly and continuously utilizing these skills. Although skills developed in producing precision jeweled movements can be utilized on other products and for other industries, it is only after long training periods that workers from other industries become qualified to make jeweled movements.

> *Dissipation of the skills presently employed either by curtailment below a minimum production level of jeweled movements or by transfer to alternative activity not requiring the same order of skills would not be in the interest of national security.*

Such skill attrition, of course, is not a serious problem in the short run when skilled workers are temporarily transferred to less exacting work in the same plant. But, if prolonged, such transfer results in loss of skill, workers leaving the plant, and cessation of training.

> *It is, therefore, not sufficient for national security purposes merely to maintain the facilities for jeweled movement production on a standby basis. It is the skills that must be maintained. This can be done only by the actual production of jeweled watch and clock movements or the parts of such movements.*

III. MOBILIZATION REQUIREMENTS

Military requirements

Procedure of study.—The Department of Defense made an exhaustive study of military requirements for the products of the jeweled-watch industry in order to consider the relative essentiality of this industry from a military standpoint.[3] A task group, composed of representatives of the military departments and the Offices of the Assistant Secretary of Defense for Supply and Logistics and the Assistant Secretary of Defense for Manpower and Personnel, formulated the methods of approach to the problem; determined the types and scope of the data required from the military departments; reviewed and evaluated these data; conducted field surveys of industrial facilities; and served generally as a focal point for coordinating the activities of the study. Coverage included mobilization requirements for jeweled movements, timing mechanisms for the ammunition program, and the interrelationship of subcontracting and parts production for other manufacturers of military equipment. All of the jeweled-watch companies, and 27 other manufacturers producing military equipment and procuring parts from the jeweled-watch industry, were visited by the Department of Defense staff in the course of the study. Order boards were obtained from the jeweled-watch companies and staff members were sent to the prime and other contractors to study the dependency of these firms upon the jeweled-watch companies.

Military timepiece requirements.—Requirements for jeweled movements during a 3-year mobilization period were found to be considerably below World War II requirements and previous mobilization estimates. Three major policies of the armed services are responsible for the reduced requirements. First, issue rates to military personnel have been drastically reduced because of the World War II experience of overprocurement and unnecessary issue of watches. Second, a nonjeweled watch has been accepted by the Army to replace the earlier seven-jewel watch requirement. Third, one service has combined the elapsed time and the standard clock into one timepiece in order to conserve space on the instrument panel, thereby reducing the requirement sharply. Considerable quantities of many of the required timepieces are already on hand.

Military fuse requirements.—The timing devices used in the ammunition program are produced by the jeweled-watch manufacturers, non-jeweled-watch and clock manufacturers, and others completely outside the horological group. There does not appear to be any of the manufacture assembly of mechanical time fuses that is peculiar to the jeweled-watch industry. The bulk of the mobilization requirements for fuses has been scheduled under the production allocation planning program. Under current plans, a relatively small proportion of these requirements is scheduled with the jeweled-watch industry. It is the opinion of the Department of Defense that the requirements now planned with the jeweled-watch industry could be handled by the other firms which manufacture mechanical time fuses and rear fitting safety devices, provided these firms are available at that time.

Subcontracting in the mechanical time fuse programs (including the rear fitting safety devices) is of considerable magnitude at the present time, and in the event of mobilization would substantially increase. During the period from the outbreak of hostilities in Korea to mid-1953 the jeweled-watch industry provided substantial amounts of defense-related parts to approximately 100 contractors. Surveys of the degree of dependency of other prime contractors on the jeweled-watch industry as a source of supply for military end item production indicate that there is no item or product which is not being made or procured in some quantity outside of the jeweled-watch industry. However, where parts have been purchased from the jeweled-watch industry, the reasons given in most cases were that the watch companies represented an excellent and de-

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[3] The Department of Defense study, app. B to this report, is classified "Secret."

pendable existing source with favorable cost relationship. Many contractors have stated that they could produce the parts which they are procuring from the watch industry, if necessary, but since the facilities of the watch manufacturers have been available to date, there has been little incentive for them to attempt to do so.

Perhaps the most critical component is the escapement spring used in most mechanical time fuse mechanisms. This spring is closely related to the hair and main springs used in watches and is fabricated from a special alloy. Although most of these springs have been procured from the jeweled-watch industry, sources outside the industry have produced this part. It is the opinion of the Department of Defense that the balance of the components, including the pinions, gears, and plates, are readily within the production capabilities of most of the facilities engaged in clock or watch manufacturing and those of many instrument manufacturers.

Research and development.—With respect to research and development work, the Defense Department found that the jeweled-watch industry is capable of doing more of this type of work than it has done in the past and that the industry appears to be proceeding in that direction.

Industry statements to the Commerce Department indicate that significant research and development contributions have been, and are being, made by this industry on the following military programs: (1) Improvement and standardization of mechanical time fuses; (2) development of electromechanical and electrical time fuses; (3) fuse miniaturization; (4) development of low-temperature lubricants for precision mechanisms; (5) development of timing release mechanisms for instrument parachutes; (6) development of gear-autosyn units for converter and radiomagnetic indicators; (7) development of production methods for piezoelectric quartz crystals; (8) research on mass production of jewel bearings and developing domestic source for producing jewel bearings; (9) research on aerial cameras; (10) development of new types of timepieces such as break circuit chronometers, memory chronographs, and underwater watches for frogmen; (11) redesign and improvement of aircraft clocks; (12) research and development of gyro, safety, timing and arming mechanisms for six types of guided missiles, including both ground-to-air and air-to-air systems.

Research and development is becoming an increasingly significant aspect of the jeweled-watch industry's contribution to national defense.

Defense supporting and essential civilian requirements

In order to arrive at a requirement for jeweled timepieces for essential civilian and war supporting use in time of national emergency, the Department of Commerce (1) considered the consumption of jeweled timepieces for nonmilitary uses during World War II, and (2) estimated the probable use of such timepieces in a future emergency. The requirements estimate of that Department were based upon the following findings:

World War II experience.—Early in World War II, it became evident that military requirements for jeweled timepieces exceeded the capacity of the domestic jeweled-watch industry, and it was determined by the War Production Board to use imported watches to meet part of the military and all essential civilian requirements. Although nearly 24 million jeweled watches and movements were imported during the period 1942–July 1945, the shortage of precision timepieces for essential civilian use was a chronic problem throughout the war.

Numerous examples can be cited to indicate the hardships and frequent production losses engendered by lack of timing devices. Military demand for jeweled timers was so great that few could be released for industrial purposes. According to WPB records, "Many of the large industries in this country who were converted to 100-percent warwork were severely handicapped by the lack of these timers * * * in June of 1944 several thousand units were produced by one of the jeweled-watch factories. This helped the situation materially but the situation quickly changed * * * and in July they were again busy making these items for the Air Corps. During the fall of 1944 the situation again became critical and it was necessary for us to secure a setback on a Navy contract to provide 250 units for release for industrial purposes during the month of December."

On February 10, 1943, War Production Board release No. 2496 appealed to the general public for the loan or sale to the Government of railroad watches. Limitation order 175 was issued in August 1942, and in each succeeding reporting period, the backlog of unfilled certified orders increased. When the order was revoked in May 1945, this unfilled balance was 18,235 units. In July 1943, there was a critical unfilled demand for 300,000 watches for hospital use. It was decided to use nonjeweled watches with conventional second hands, in place of the sweep type normally used on nurses' watches, to fulfill this requirement. It was believed that these 300,000 watches could be produced in a relatively short time. Due to the volume and urgency of warwork being done by the nonjeweled watch industry, however, only 140,148 units had been delivered by the end of the year.

In the spring of 1944 the shortage of miners' watches became critical. After much effort the War Production Board obtained 17,324 nonjeweled pocket watches which were turned over to the Mining Division (WPB) for distribution. In November 1944 an additional 1,000 units were assembled specially from semifabricated parts and were also directed toward this same need. Of these 1,000 watches to be allocated to miners, a total of 502 were diverted to the Army Engineer Corps for oversea military use, and it was not until May 8 of the following year that additional watches were secured for the Mining Division.

In 1944 the shortage of repair parts became so acute that the Department of State had to arrange with the Swiss Government under the compensation agreement for the importation of $350,000 worth of needed watch parts.

According to War Production Board data, approximately 23,822,000 jeweled watches and movements were imported into the United States between January 1942 and July 1945. Of this total, some 4.526,000 units were pin lever, cylinder, Roskopf, and jeweled watches smaller than 6¾ ligne. This leaves 19,296,000 jeweled watches of a type and size suitable for most essential civilian uses. Reducing this amount by 2,400,000 (the number diverted to the military under WPB Order L–323) aind caluculating the balance on an annual basis, leaves 4,825,000 imported timepieces per year available for essential civilian use.

The Department of Commerce estimates that roughly 40 percent of the above total was actually put to war supporting use. Using this estimate and adding the 84,000 jeweled timepieces per year that were domestically manufactured under WPB authorization for specific industrial needs, estimated essential nonmilitary consumption of jeweled watches during World War II averaged 2,014,000 units per year.

Essential civilian requirements for jeweled timepieces.—Applying the experience of World War II, the Department of Commerce evaluated economic and population changes and increased civil defense requirements in estimating the probable defense supporting and essential civilian requirements in any future mobilization. Specifically, the estimates were based on the following considerations:

(1) The records of the War Production Board, portions of which are cited above, indicate that essential civilian and war supporting demand for precision timepieces, during World War II, were not fulfilled and distress occurred in several areas.

(2) Postwar population increase and industrial expansion have increased the demand for timepieces. In planning the needs for the manufacturing, mining, and railroad industries as typical large consumers of precision timepieces, it is estimated that the work forces of these industries will increase to 29 million as compared to 20 million during World War II. This estimate is derived from the data contained in the Statistical Abstract of the United States, and assumes the same proportionate increase in work levels over 1952 levels as occurred during World War II.

(3) Planning for future emergencies must take into account the increased needs for precision timepieces for: Hospitals, aircraft spotters, dispersed standby reserves, and many other civil defense activities not planned during World War II.

(4) In arriving at estimated requirements, consideration was given to maximum possible utilization of all civilian timepieces available, including stocks in the hands of retailers.

On the basis of the above considerations, the Department of Commerce estimates that defense supporting and essential civilian consumption of jeweled movements in any future mobilization period would be at least 1 million more movements per year than were required in World War II. Furthermore, in planning for future emergencies, no reliance can be placed on foreign sources for precision timepieces.

It is the considered judgment of the Department of Commerce that domestic production of a minimum of 3 million jeweled timepieces per year will be required to meet essential nonmilitary requirements under conditions of full mobilization.

IV. THE ESSENTIALITY OF THE INDUSTRY TO MEET MOBILIZATION REQUIREMENTS

The Department of Defense has found that military requirements for jeweled timepieces are relatively small and that these requirements could be stockpiled if it appeared that the capacity of the industry were to be lost. It regards the facilities of the industry as highly desirable capacity for the manufacture of other military items but believes that all items other than jeweled movements would be procurable from suppliers outside the jeweled-watch industry.

On the other hand, the Department of Commerce estimates that essential civilian requirements for products uniquely supplied by the jeweled-watch industry would be far larger than in World War II. Moreover, between 1942 and July 1945 nearly 24 million jeweled movements were imported from Switzerland and it appears unwise to count on any imports of jeweled movements in the event of a future war.

Although these various requirements estimates have been made as carefully and soundly as possible, we call attention to the difficulty of predicting military or civilian requirements for precision jeweled timing mechanisms in a period of rapidly changing technology. It is a well-known fact that with the increase of speed and complexity of operations, both industry and military units require more and more precise and dependable measurement of time. As is usually the case in technological development, the changes taking place in the manufacture and use of timing mechanisms have eased certain problems but have created new ones.

There are certain additional factors which may generate important requirements for jeweled-watch movements or seriously reduce our capacity to produce such movements. The jeweled-watch industry has made a significant start in research and development involving extreme precision, miniaturization, and instrument sensitivity. The direction and rate of growth of such research and development could have an important bearing on mobilization requirements placed on the industry.

A factor of even greater importance and more difficult to evaluate is the potential impact of enemy attack. Such an attack might both substantially reduce the capacity to produce jeweled movements and other precise mechanisms and at the same time greatly expand requirements for such products. For example, of the 27 concerns outside the jeweled-watch industry which participate in the fuse programs, 13 are located in vulnerable areas and 4 more are in questionable areas.

All our past experience demonstrates that the jeweled-watch industry is the sole domestic supplier of jeweled movements and is a highly qualified segment of the supply base for other military and defense supporting products.

The statistical estimates of end items requirements from the industry indicate that very substantial demands would be made on the industry in the event of full mobilization. Even so, these estimates must be augmented by intelligent appraisal of the variable factors which may emerge as highly important and by our experience in the last war.

Past experience, known requirements, and reasoned judgment all lead us to conclude that the skills of the jeweled-watch industry constitute an essential part of our defense mobilization base. These skills should be maintained at a level from which a quick and effective expansion of production can be made in the event of national emergency.

V. MAINTENANCE OF THE INDUSTRY

What is a safe minimum level?

The problem of determining at what level of output adequate skills are maintained is not a simple one. Because of flexibility in total programing and rapid technological changes, it is always extremely difficult to determine the exact future requirements for any product or item under full mobilization conditions. Since almost any type of industrial capacity for manufacturing defense products is generally essential and limited in an all-out mobilization effort, it is necessary to consider the degree of essentiality of this industry and the minimum level at which it can be maintained to provide a nucleus for expansion.

Although the capacity of the jeweled-watch industry is highly desirable for the production of mechanical fuses and other precision military items, the Department of Defense study showed that there are other facilities capable of producing such items. Accordingly, any special governmental action to sustain the industry must be based upon the need for preserving the skills required for manufacturing the products uniquely available from the industry. The fact that the industry has the ability to produce other essential military items, and that its capacity would undoubtedly be used to the fullest extent in any future mobilization, is a corollary consideration which emphasizes the importance of these skills and facilities to the national security.

Considering only the estimated requirements for military and essential civilian jeweled timepieces, it is estimated that 6,000 production workers would be required for the manufacture of essential civilian items and 1,100 would be needed to make military items, or a total of 7,100 production workers.

Expanded output in wartime can be achieved from a given supply base of skills by increasing scheduled weekly hours, job breakdown, and shifting part of the work force now utilized in the production of other defense items. Additionally, due to improved efficiency and the greater availability of jigs and dies, it is believed that the industry could achieve a greater relative expansion in a future emergency than the 50 percent expansion it underwent in World War II.

If as much as a 100-percent expansion of the industry could be achieved in a future mobilization, it would appear that, at current productivity rates, a minimum of 3,500 watch production workers should be continuously employed by the industry in peacetime to provide the nucleus of an expandable base. These calculations exclude entirely the presently planned allocation to the industry of other military items the production of which, by themselves, would require a larger work force than is now available in the industry.

With the allowance of a small safety factor in view of the admitted difficulty of making valid estimates of future requirements, it is the judgment of the committee that the peacetime production of jeweled watch movements should be at least an average of 2 million units per year, which at current levels of productivity would provide employment for about 4,000 production workers.

Consideration must also be given to the minimum level at which the industry can profitably produce and sell jeweled movements. Statements made by various representatives of the industry have suggested that the break-even point of watch production may be somewhat higher than 2 million units per year.

The committee has not attempted to determine what is the minimum economic level at which the industry can produce watch movements profitably. It is clear, in any event, that the present downward trend in watch production must be halted and reversed.

A second question of considerable importance concerns the minimum number of firms which should be maintained in the industry in order to assure the essential mobilization base.

Several factors bear on this question. Any further reduction in the already small number of firms in this industry would greatly increase the vulnerability of the industry to air attack or sabotage. In the event of peacetime loss of one or more of the firms, it appears likely that there would be a considerable net loss of skilled workers from the industry who would not choose to move their residence in order to accept employment with the remaining firms. In addition, while there is a similarity of operations among the four watch companies, some types of equipment are peculiar to individual companies and are not to be found in other industries in the United States. Thus each company contains elements of irreplaceability, quite aside from its necessary share in meeting total production requirements.

On the other hand, it would be undesirable for the Government to take action to sustain individual companies if they cannot compete effectively with other members of the industry in an economic climate favorable to the industry as a whole.

Any measures taken to assist the industry should, insofar as is practicable, serve the purposes of preserving the watchmaking skills in all four domestic producers, but special efforts should not be made to preserve any individual companies if it appears that they cannot by reasons of less efficient management or production processes, continue watch production in competition with the rest of the industry.

Measures to sustain watch production

The best longrun answer to the maintenance of the skill and facilities base in jeweled watch manufacturing is a healthy competitive industry.

The companies in this industry are not economically dependent solely on the production of 17-jeweled watches. There has occurred in recent years a definite shift in domestic production into 21-jeweled movements. These watches are in a more favorable competitive position with imported movements of the same number of jewels because of higher tariff protection. The industry is receiving a substantial amount of defense contracts which enable the companies to maintain facilities and employment and to obtain experience in producing items that are likely to be procured from them in full mobilization. These last two factors contribute substantially to the maintenance of their plant and equipment, supervisory staff, toolroom, laboratories, and special mill facilities. It is possible, furthermore, that the companies could go further in insuring maintenance of facilities, employment, and profits through increased technological advances to improve efficiency, more aggressive selling, and diversification of the products manufactured by them.

The above factors are important because insofar as the industry can by its own watch selling efforts, along with currently planned defense procurement, maintain an adequate supply base of skilled workers and at the same time remain in a healthy economic condition, additional Government intervention and controls would be unnecessary and certainly undesirable.

> *All of the suggestions considered by the committee to assist this industry to maintain watch production have disadvantages.*

Those disadvantages include one or a combination of the following: higher prices for watches to the consumer, increased Government costs, direct Government intervention in the affairs of the companies, inhibition of competitive stimuli, or governmental policy to curtail rather than extend international trade with concomitant international political and economical effects.

> *On the other hand, the single and compelling justification for Government action is to maintain a minimum skill supply to meet national security requirements.*

In examining proposals for maintaining watch production, the committee in most cases did not have sufficient information on the profit conditions of the industry, price and selling practices, adequacy of modernization programs, and possible results of specific actions on sales of domestically produced watches in relation to imported watches to provide definitive conclusions or to recommend specific courses of action to be taken.

Listed below with a brief evaluation, are measures which have been suggested to the committee to sustain watch production at the minimum safe level. With respect to some of these proposals, questions of legal feasibility may arise and involve the enactment of new legislation.

> *The committee has made no detailed study of either the practicability or desirability of any of these measures. While it is believed that some of these measures individually or in combination have sufficient merit to justify further consideration, their inclusion in the report does not constitute endorsement of any of them by the committee.*

1. *Advanced procurement of military timepieces.*—Assuming the availability of funds, some early assistance could be given the industry by advanced procurement of military timepieces to meet mobilization requirements. It would result in a stockpile of items needed in full mobilization and the possible reduction in procurement of such items requiring highly specialized skills in an emergency. This measure is useful only as a stopgap device for maintaining essential skills until other methods of assistance to the industry can be effectuated.

The disadvantages of this measure are (1) possible waste in terms of purchases which may not be needed because of changes in requirements, and (2) because of the limited mobilization requirements for military timepieces the aid would be limited and once requirements are met could not be continued.

2. *Preferential procurement of other products.*—Preference in the procurement of fuzes and other items could be given to jeweled watch producers over other domestic producers of these items. Among the domestic jeweled watch producers preference might be given to companies judged to be in greater need of assistance. This might result in concentration of procurement on the least efficient producers and would probably result in high-average costs. Furthermore, this action would assist the profit and employment levels of the companies

but would not, in itself, lead to increased production of jeweled movements and the utilization of watchmaking skills. This measure would not add to the overall mobilization for fuze requirements and would discriminate against other domestic producers of fuzes and similar items.

3. *Tariff relief.*—The U.S. Tariff Commission has held hearings on this industry and has submitted its report and recommendations to the President with respect to remedial action under the escape clause of the Trade Agreements Extension Act. The Government therefore has before it extensive information and expert judgment as to the applicability of tariff relief to preservation of the industry.

The Treasury Department and the Bureau of Customs have before them an application submitted for the American jeweled watch industry asking a change in the practice of applying paragraph 367(a)(4) of the Tariff Act of 1930 which provided for additional duties of $1 (reduced to $0.50 by the Swiss Trade Agreement) for each adjustment made on imported movements.

The Committee does not feel qualified or called upon to express a view with regard to these measures.

4. *Quotas.*—It might be possible to maintain an adequate domestic production level by making an agreement with the Swiss Government for appropriate division of the U.S. market based upon our needs for national security. There is in the 1946 agreement precedent for the establishment of quotas.

One of the principal difficulties with this proposal is that it would remove one of the main factors which has encouraged the American watch industry to improve its production efficiency, that is, the need to try to meet foreign competition. If the formula assured American industry of a share of the American market, the need to cut costs, improve the quality of the product, and remain alive to technological advances would be very much reduced. Furthermore, this limitation of supply might well result in higher prices for both domestic and imported watches beyond the level necessary to support the mobilization base.

Moreover, there is no guarantee that a quota limitation on imports would give American producers the protection which may be needed. Quota limitations provide incentives to smuggle. Even if quota regulations could be enforced, it is not certain that the limitations would necessarily assure maintenance of American production. The effects of quotas have become even more difficult to assess since all domestic producers are also importers.

5. *Subsidies.*—Subsidies to the industry could be made in various ways such as tax rebates, incentive payments in relation to production attainments, or a specified payment for each domestic jeweled movement produced up to a certain level, related to differences in cost between imported and domestic movements.

Subsidies imply increased Government costs and industry dependence upon the Government. However, these costs are generally obvious and therefore may be preferable to hidden costs which would be paid by the American people under alternative measures.

Subsidies, if carefully applied, would not inhibit competition by the firms in the industry or discourage efforts to improve the efficiency of production processes or marketing techniques. Furthermore, they would not necessarily increase the price of watches in the market. The use of subsidies would require careful and continuous scrutiny of the companies in the industry by the Government to ascertain that the subsidies are in fact achieving the objective of maintaining production of watch movements.

6. *Advancement of horological techniques.*—Long-range assistance might be rendered the entire American horological industry through establishment of one or more research, development, and training institutes. Such institutes would, through contributions by the Government and industrial firms, provide centralized facilities for advancement of technology in the horological field and enable domestic firms to compete more effectively with foreign competitors.

VI. CONCLUSIONS AND RECOMMENDATION

Conclusions

The Committee concludes on the basis of the information and judgment available to it that:

(1) Preservation of the skills of the American jeweled watch industry is essential to the national security.

(2) Manufacture of jeweled watch movements should be maintained at levels of production and employment which would enable the industry, in the

event of full mobilization, quickly to expand to meet military, defense supporting, and essential civilian requirements for items uniquely produced by workers having watch manufacturing skills.

(3) It is impossible to determine precisely the exact level of production and employment necessary to assure an adequate mobilization base in the jeweled watch industry. However, it is the judgment of the Committee that it would be detrimental to the national security to permit further impairment of jeweled watch production in the United States. It appears probable that domestic production of jeweled watches should be maintained at not less than an average of 2 million units per year in order to assure an adequate base from which to expand to meet full mobilization requirements.[4] The Committee recognizes that this minimum level for preservation of key skills may not be sufficient to assure that production in the industry will be an economically feasible operation.

(4) The levels of production and employment in jeweled watch manufacturing are now below the levels which would enable the industry to expand quickly and effectively to meet the requirements of full mobilization.

(5) The downward trends of production and employment in the industry are likely to continue, thereby further impairing the industry's base of critical facilities and skills, unless the Government acts to create conditions favorable to higher levels of production and employment in the industry.

Recommendation

In the light of the foregoing conclusions, the Committee recommends that the Government take actions which will create conditions favorable to the continued manufacture of jeweled watch movements by the American jeweled watch industry at a level which will maintain an adequate base of skilled manpower capable of expanding to meet full mobilization requirements.

Appendix A

List of firms and persons who met with Interdepartmental Committee on the Jeweled Watch Industry, February 24 to March 1, 1954.

IMPORTERS

Benrus Watch Co., 200 Hudson Street, New York, N.Y.	S. Ralph Lazrus, treasurer; and president, American Watch Association, Inc. Norman Slayter Millard E. Tydings, counsel Henry V. Poor, counsel
Gruen Watch Co., Time Hill., Cincinnati, Ohio	Morris Edwards, president

CLOCK AND NONJEWELED WATCH MANUFACTURERS

Clock Manufacturers Association of America, Inc., 215 Church Street, New Haven, Conn.	Joseph T. Ingraham, president; and vice president, E. Ingraham Co., Bristol, Conn. Albert L. Reeves, counsel John E. Hartshorn, counsel
Borg Products Division, Geo. W. Borg Corp., Delevan, Wis.	Carl Keck

OTHERS

Camera Works, Eastman Kodak Co., Rochester, N.Y.	N. B. Green, general manager
Eclipse Machine Division, Bendix Aviation Corp., Elmira, N.Y.	R. E. Posthauer, manager of Government contracts
King-Seeley Corp., 315 South First Street, Ann Arbor, Mich.	William W. Lewis, works manager

[4] It is the opinion of the Department of Commerce that an annual production of not less than 3 million units is necessary to provide an adequate mobilization base.

JEWELED WATCH MANUFACTURERS

American Watch Manufacturers Association, Inc., 1100 Shoreham Building, Washington, D.C.	Paul Mickey, vice president
Bulova Watch Co., Bulova Park, Flushing, N.Y.	Arde Bulova, chairman of board Stanley Simon, vice president Gen. Omar Bradley, chairman of board, Bulova Research & Development Corp. Marx Leva, counsel Lloyd Symington, counsel
Elgin National Watch Co., Elgin, Ill.	William M. Brandes, vice president Leroy Mote George Fraker
Hamilton Watch Co., Lancaster, Pa.	Arthur Sinkler, executive vice president R. J. Blakinger Frank A. Christoffel
Waltham Watch Co., Waltham, Mass.	Teviah Sachs, president W. D. Sparks S. Johannesen

LABOR UNION

American Watch Workers Union, care of Local 479, Waltham, Mass.	Walter W. Cenerazzo, national president