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THE MACHINE TOOL INDUSTRY IN WORLD WAR II
26 March 1946.

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GENERAL ARMSTRONG:

Gentlemen, I have a very distinguished speaker here this morning. I asked his permission to allow the Assistant Commandant, who is an old friend of his, to introduce him. I asked him if he would mind having the introduction made by somebody who knew him. He said he would prefer to have someone who did not know him make the introduction. But, regardless of the distinguished speaker's wishes in this case, I am going contrary to them, because his extremely distinguished career deserves, I think, a cataloguing that Captain Henning can give you, because of his personal acquaintance, more effectively than I can. Captain Henning, will you introduce the speaker?

CAPTAIN HENNING:

I know that long introductions are rather questionable, but if I recounted all of Mr. Ralph Flanders' accomplishments and talents, I could not escape from a prolonged introduction.

I know of hardly anyone in the industrial or economic field in the United States who has a broader background than Mr. Flanders. In his early days he was noted as a designer of machine tools and industrial machinery. He eventually became the president of the Jones and Lansing Machine Tool Company. In later years he has been the president of the Federal Reserve Bank of Boston.

He is noted as a author, not only of a book on industrial matters, but in the field of economics. He is the author of the well-known book "Toward Full Employment," 1938. During World War II he was the head of the machine tool priorities in the old OPM. At the present time he is a member of the Committee for Economic Development, which has recently been called upon to testify before Congress in such matters as price control.

These are only a few of the accomplishments of Mr. Ralph Flanders. I doubt whether the College will have the opportunity to hear an address by anyone from whom more profit can be gained. Mr. Flanders.

MR. FLANDERS:

Thank you, General Armstrong and Captain Henning. As a matter of fact, there is not one of us, but two. I have along with me a man who really knows something, Mr. Tell Berna, whom some of you know--the manager of the Machine Tool Builders Association. I shall very largely cover the glittering generalities and with your kind permission will leave Mr. Berna to give you the low-down. By dividing things up in that way I hope to get all the plaudits and let him get all the grief.

One of the pleasant parts of what was on the whole a not particularly pleasant term of duty down here in OPM was getting acquainted with Captain Henning. I say "not particularly pleasant" because I find myself unfitted for working under government conditions. It can be very simply explained by saying that, while I had a blow-off valve, I did not have a pressure gauge. I never knew when that valve was going to pop. It surprised me as much as it did anybody. So I concluded that my forte lay outside the Government--that, after all, there would have to be a few of us outside the Government.

My topic is "The Place of the Machine Tool Industry in National Defense".

It must be a matter of firm conviction with those who have been concerned with the production problem of national defense that the heart of the problem is to be found in an adequate machine tool supply, provided in time and of the proper varieties and sizes to support a coordinated war production.

You have been well informed on this subject by one who lived with the problem throughout the Second World War, who saw it in detail and as a whole and who played a major part in bringing into the confusion of the problem such order as is possible under the stress of war and a constantly changing program.

The paper to which I refer is that which was read before you by Captain Henning under the title of "Machine Tools in World War Two". It is my judgment that Captain Henning's contribution to this basic problem of war production exceeded that of any other member of the Armed Forces, bar none. I am glad of this opportunity to pay this tribute to his judgment and effectiveness.

A number of things in that paper are worthy of your careful attention. The history of the device which went under the name of "Pool Orders" leads one to the conclusion that this is an invaluable method of preparing in advance for a flood of productive equipment for war material whose exact nature has not yet been decided upon. Were we to wait for the final determinations of designs and quantities of material before placing equipment orders, the war might well be lost. Wise judgment in the placing of pool orders gives production a running start, as each item of the program becomes definitely translated into orders.

The confusion of overlapping claims, by-passing authority, "green lights" from on high and all the other embarrassments to production with which earnest officials sought to discharge their responsibilities were very largely resolved by Captain Henning's device numbered and known as General Preference Order "E-1-b". No device is perfect, but no means of bringing order out of chaos was found during the course of World War II which worked as well as this one. In any future emergency we should place our initial reliance on a similar procedure and only modify it if demanded by the situation as a whole. I have an idea that little modification will be found possible or desirable.

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Let me add a little at this point to my earlier statement about pool orders.

I suppose it is a truism, so far as the conduct of war is concerned, that war is wasteful. At first thought it seems wasteful not to proceed in the orderly way of first establishing the design of your materiel; and, that being done, going out to find the contractors for building it; and, that being done, have the contractors get together their equipment and have them all start making the stuff. That seems like the orderly procedure.

But, as a matter of fact, it is necessary in the interest of speed to telescope all of those things and have them proceeding simultaneously. On the equipment end of that the pool order is the device for getting your equipment together simultaneously with the final determination of the design and simultaneously with the selection of the contractors who are to produce it. The orderly procedure would be an extremely unfortunate thing to pursue. On the equipment end the pool order is necessary.

Now, coming back to this question of the orderly allocation of machine tools which was tasked by General Order E-1-b:

The President of the United States gave a "green light" on a particular project at one critical stage in our war production. This should not be done again in the future, except as agreed upon at the general staff level by men in close contact with the production problems of all the war materiel on order.

There of course may be, in the future as in the past, projects of importance so overwhelming that the "green light" is appropriate. The Manhattan Project was one such, and it may be that if we have a crisis in the future some corresponding overriding priority may have to be given to one or two undertakings. Such projects are rare and a long war might easily be lived through without any necessity for an overriding priority such as the Manhattan Project enjoyed and deserved.

Machine tool builders are proud of the part they played in the expansion of defense and war production. We were only a part of the astonishing production record of the United States, but we were an early, a basic and an irreplaceable part. We are concerned in playing that part well in any future emergency, and the purpose of this talk here this morning is not so much to give instruction as to confer with you as to the means by which we may hold ourselves in effective readiness and properly meet our responsibilities when need arises.

First, let us get a picture of the industry as a whole. It has a number of unusual characteristics. Captain Henning was good enough to suggest that honesty is one of those characteristics, and he allied this with the necessity for high accuracy on our product. This may very well be an important reason for the rather high level on which the business operations of the industry are transacted. I venture, however, to suggest that we are only a part of a high-grade production unit in the American economy. If we, ourselves, have a good record for honesty, our customers

merit the same praise. I know, in fact, of no other industry in which the producer may trust the purchaser to the extent that is normal in the machine tool industry.

I might say that the average record of bad debts, uncollectable debts from customers, in the industry runs in fractions of one percent. It just indicates the nature of the industry from the nature of the customer with which we deal. Those fractions of one percent are almost entirely matters of misfortune rather than dishonesty. Customer relations are on a very high plane indeed, but that level is largely due to the intelligence and honesty of the customers, and I venture to suggest that our own good policies are derivative rather than determinative.

Another characteristic of the machine tool industry is that it is composed of a great number and variety of small units. Some 200 to 300 companies make up the list. They build machinery in a wide diversity of kinds and sizes and no one company, or even organized group of companies, comes close to completely fitting out any ordinary machine shop establishment.

The definition which perhaps best unifies the divergent machines classed together reads somewhat as follows: "A machine tool is a machine portable by hand which removes metal in the form of chips by cutting or grinding." This definition leaves out various types of presses for cutting, bending, forming, forging, etc. These presses are so nearly allied to what are commonly called machine tools that they have to be included with them in any consideration of defense or war production. So for military purposes, they should be classed as machine tools.

Within this definition are to be found a very wide variety of kinds of machines. The oldest and the basic machine tools are the lathes, drill presses and planers. The lathes are of many kinds. There are plain turning lathes, commonly called engine lathes, and ordinarily provided with means for screw cutting. Besides this, there are turret lathes which present a number of tools in succession to the revolving work held in the spindle. There are, likewise, automatic lathes of various sorts--some of them Turret Lathes and others with other means for presenting a variety of tools simultaneously or in succession for performing a number of operations at one setting. These lathes are, for the most part, automatic in the sense that the workman puts the work into the chuck, whereupon the machine goes through a cycle of operations, upon the completion of which it stops the rotation of the work so that the operator can put in a new piece.

I might say parenthetically that I have amused myself with designing the machine tool that can be most easily sold in the next decade or so. This will be a machine tool for high-production purposes. It will be one in which the machine faces the worker instead of the worker facing the machine; and it will be one in which the worker does no work. A machine of that description commends itself both to management and to labor.

That type of machine is not the kind of machine with which wars will probably be fought, because it represents too long a course of development for specific operations on specific parts. By the time we get it designed and going, we might be licked.

The farthest development of the automatic lathe, however, is to be found in the automatic screw machine, either single or multiple spindle, into which long bars of stock are put, from which pieces are successively machined and cut off often in finished form.

Another variant of the basic lathe is to be found when the spindle is designed to revolve about a vertical instead of a horizontal axis and is provided with a revolving face plate or table. The lathe then becomes a boring mill, which is often provided with a turret and is then sometimes called a vertical turret lathe. A still further development of this type of machine produces a multiple spindle automatic boring mill for medium-sized parts in high production.

As to the drill presses, there are innumerable varieties of them, though with less variation in their design and function than in the case of the lathes. Some of them are hand-operated for very light work, some have spindles in a fixed position, and are therefore called post drills or given some similar designation. To drill holes in various parts of a piece of work with such a drill, the work has to be moved about on the work table. This type of drill is, therefore, commonly used for comparatively light work or for pieces in which only one hole is to be drilled.

A more elaborate development is the radial drill in which the drill spindle is mounted on a swinging arm and can be moved toward or away from the axis about which the arm swings so that it may take any position in a wide segmental area. Quite naturally this type of drill is used on heavier parts which cannot be moved about under the drill spindle.

In another direction the drill press has developed into the horizontal drilling boring and milling machine by mounting its axis horizontally in a head which, in combination with a moving work table, permits the drill to be presented to the work at various heights and in various horizontal positions. This, likewise, is used generally, although not exclusively, on heavier work.

The third basic machine is the planer in which ordinarily the work reciprocates beneath a tool-point which may be raised and lowered or moved to the right or left. Unlike the lathe which is designed for machining cylindrical or conical or other surfaces symmetrical about the rotating axis of the machine, the planer is primarily intended for making flat surfaces at various positions and at various angles on a piece of work which is ordinarily of medium or large size.

For small pieces, the same operations are often performed by the shaper, which is a modification of the planer principle in which the tool is reciprocated instead of the work.

Milling machines are another exceedingly important type of machine tool in which a rotating cutter mills flat or angular or formed surfaces in accordance with its shape on a piece of work which is fed past the cutter. The milling cutter itself may be held in a vertical or horizontal axis or at an inclined axis. The milling machine is the typical machine used in the production of small arms.

I have, by the way, always been intrigued by the French designation for a milling machine. They call it "machin a fraise," coming from the French word "fraise" meaning "strawberry." That sounds a little bit difficult to understand until you realize that the first milling cutters were little more than rotary files and some of them had an extraordinary shape a little approaching a strawberry, the little dots in a strawberry representing the teeth on the rotary files. That is why the French call them "strawberry machines."

There is another French name for a machine tool which still remains a mystery to me. That is what we call a turret lathe, a small turret or screw machine. They call that a "machin a decollete." Just what that means I do not know. I will find out some day.

A near relative of the milling machine is the broaching machine. Here, instead of a rotating cutter with teeth, we have a long cutter bar, likewise provided with teeth, which performs its operations by being drawn past or through the work. Broaching machines are built in all degrees of size and complication.

The most elaborate modification of the milling machine is that designed for finishing complicated and irregular shapes, on the principle of having the mill duplicate a pattern. This machine found large use in World War II.

Lastly in the list of machine tools, properly so-called, come the various grinders. There are cylindrical grinders for finishing external cylindrical or conical surfaces with an abrasive wheel. The internal grinders do the same for cylindrical and conical holes. Faces and surfaces are finished by face grinders and surface grinders.

The work may either be reciprocated past the wheel or may be revolved in contact with it.

Lastly, comes the most recent development in the grinding machine, world--the thread grinding machine which came into new and extended use during the war--both for making cutting tools and gages and for grinding accurate threads on the components of ordnance, airplanes and armament in general.

These foregoing paragraphs are all elementary and doubtless tell you nothing that you do not already know. The mere listing of these types of machines, however, is helpful in indicating their variety. The number of items that make up the complete list of machine tools is, however, further complicated by other types of variation.

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Machine tools may, for instance, be so-called "standard" machines or they may be standard machines organically adapted to receive specialized equipment or, finally, they may be completely "special" in themselves. As examples of the preceding three classes of machinery, the commercial engine lathe may be taken as an example of the standard type. Certain kinds of automatic lathes with high production equipment which in many cases is more expensive than the machines on which they are put are good representatives of the standard machine designed to use special equipment to advantage. For the really special machines built to perform to the maximum of output and accuracy, certain special operations on particular parts, the extreme in elaboration, size and effectiveness was perhaps reached in the airplane cylinder finishing machines developed by Greenlee Brothers and Company for the Studebaker Corporation and later used by most large scale manufacturers of airplane engines. Here, the work was mounted in fixtures and carried by successive movements of an endless track past many machining stations at each of which were grouped the drills, spindles, mills, etc., needed to take the successive cuts and complete the part for assembly into the engine.

Machine tools may again be classified as light, medium and heavy and this applies to almost all of the types of machines already described. There is a real difference in the manufacture of these different kinds. There was, for instance, a rapid development of extremely light machine tools, to some extent lathes, but particularly drill presses and millers, which came about with the large use of aluminum and magnesium in plane and plane engine manufacture. These tools, in general, developed out of the cellar work-shop type of machinery, sold originally and primarily by the mail-order houses. Their usefulness, however, in aluminum-magnesium manufacture and their progressive development to meet high production demands assures them of a permanent place in the list of production machinery.

Numerically the great bulk of machine tools can be classed as medium, and it is in this medium field that the great variety of types and sizes and the great number of specialized machines are to be found.

Almost any of the various machines described can be obtained in the extremely heavy sizes. Typically, the heavy machine tool builders will design and construct almost any type of machine in the large size. In general, they go in for a much wider variety of types of machine tools than does the builder of either the medium or the light machinery.

Still another subdivision can roughly be defined as the difference between precision and commercial machines. The distinction between the two types is not an invidious one. The machine of sound commercial design and construction covers the greater part of production demands and it is wasteful to demand the precision type of machine where the commercial type will do. In fact, there is a tendency, perhaps, for commercial machines to be rather more productive than precision machines, the latter having sacrificed something in ruggedness and cutting power to the demands of extreme accuracy.

The complexities and innumerable variations of machine tools have been perhaps too much emphasized in this talk up to this point. It is nevertheless of great importance to realize that the industry is really a collection of many industries. There are no single shops that cover the entire line required for war production. No single shop, in fact, comes anywhere near covering the entire line. Furthermore there is no selling agency which carries a complete enough line of machines made by their group of manufacturers to be able to equip a shop complete for any ordinary product of war production. Multiplicity of product and size for the industry, and comparatively small variety of output for the individual builder, is a condition which must be recognized in organizing the machine tool industry for war output. All of these points must enter into any future planning procedure and must all be taken into account.

As to our future policies, a few things seem clear, at least to your speaker.

One of the most important is that a good-sized pool of machine tools should be held in reserve. Except possibly in some special cases, of which projectile and turning machinery might be an instance, these machines should be of standard type. Experience seen from the machine tool builders angle indicates that the design of materiel for one war is no guide as to what will be required for a subsequent one. The standard types of machinery can be thrown into production of almost any design in the first instance and a high output can be obtained from them, giving time to develop more specialized high-production methods.

Particular attention should be given in selecting machinery for the pool, that so far as possible it has the necessary rigidity, power-input and speed to use carbide tools successfully. There is such a great step-up in production with carbide tools that no compromise should be made as between suitable and unsuitable machines where the former are available.

The first of these pooled machines should go to completely modernizing the government establishments. After that, there may be chosen from the remainder those which are to go to reserve.

I realize in making these suggestions I am not recommending new policies, but am simply restating the existing policy of the Armed Services. I do, however, wish to urge that this process of re-equipment of government establishments and selecting the machines which are going into the reserve pool be more earnestly pursued and greatly accelerated. This is not only for the advantage of the Government, but it will be of great assistance to the industry in solving the serious problems which face them in view of the at present unknown volume of surplus machinery which hangs over their market. If the industry is to be and to remain in a healthy condition, it must know what it has to face in this respect at the earliest possible moment. The Armed Services have a strong interest in having a strong machine tool industry which is not faced with unknown problems which the Armed Services can assist them in solving.

It is further highly advisable for officers with the most knowledge and experience in machine tools and production to be detailed to keep track currently of machine tool developments. They should furthermore from time to time, by visits and in other ways, keep track of the machine tool shops themselves, so that they will have visual and personal knowledge of the extent to which they are growing, of their success in keeping abreast of the times, and of their ways of meeting the various problems of the industry.

I am strongly of the opinion that in the event of a future war this continuing contact between the Armed Services and machine tool builders will work out far better than the most elaborately detailed preplanning of operations and equipment.

It is most disturbing that we have to talk at all about a future war. Let us speak only of a barely possible future war. I am sure that all of us here feel that industrial preparedness is one of the things which exerts an influence away from war rather than toward it, and in industrial preparedness there is no more important single element than a machine tool industry in a strong and healthy condition, prepared to go into action when the danger signals are raised.

GENERAL ARMSTRONG:

Thank you very much, Mr. Flanders. I should say that, instead of the glittering generalities that you promised us, you have given us a very specific and valuable program.

I want to say, gentlemen, that my experience, if you will pardon my personal reference, confirms absolutely everything that Mr. Flanders has said. I would add this: that in this new course of training officers for industrial mobilization I would include in the first year's course, to be given in a civilian institution, a rather elaborate course on machine tools and their use. I consider that absolutely fundamental.

An officer does not necessarily have to know the technology of iron or steel or any of the other innumerable technologies. But if any officer tries to do a job in the procurement districts or even supervise on the top level of industrial mobilization activities without a sound knowledge of machine tools, he is lost and he can not do a decent job.

Again, to be personal, I can tell you this: that when I went out to Chicago to handle that district in July of 1939, what was my first activity? It was to visit the machine tool builders. One week after I reached Chicago I went to Rockford, Illinois, and met all the machine tool builders--and there were many of them in that city--and then visited their plants, later taking in Milwaukee and other places.

I say to you that during the war, while we were building up the production in Chicago and in all other places, the great problem was machine tools. And what Mr. Flanders has said about the machine tool industry and the important role that it plays in our Army and Navy is absolutely correct. If we allow the machine tool industry to deteriorate, we do it at the cost of national security. And anything that any of us can do, gentlemen, in bringing that point of view to the public is a responsibility that I think we must all accept.

Now, the next speaker, who is going to talk, according to Mr. Flanders on the pick and shovel level, is an old friend of mine; so I am going to introduce him.

As a matter of fact, realizing the importance of machine tools and also agreeing wholeheartedly, as you full well know here, with what General Eaker said to this class the other day about the importance of the relationship between the Armed Forces and industry, we have set up industry advisory committees. Again I call your attention to this fact: that the first committee that I organized was with the machine tool industry. And that was not purely fortuitous. That was done advisedly, because of the fundamental importance of the machine tool industry.

So that committee, which we set up with the cooperation of Tell Berna, was in a sense a guinea pig. It was the first of our committees. It proved to us that those committees could accomplish constructive results for the business for which we were responsible here in the Industrial College. We are grateful to Mr. Tell Berna for what he could do and what he did do to make that initial committee successful.

Now, besides being an expert on machine tools, if we were to give him a French name, we would call Mr. Tell Berna a "machiné a courir." That means that he can run. He was an Olympic athlete. Gentlemen, I present to you not only a distinguished machine tool specialist, but a distinguished athlete, Mr. Tell Berna.

MR. BERNA:

General Armstrong, on that reference to the athlete you missed me by some thirty years.

General Armstrong, Captain Henning, and gentlemen: I am in a very tight spot. In the first place, my highest military rank was that of private. The euphonious title of "private first class" had not at that time been invented. I was just a private. I find myself in the presence of a great deal of brass. Furthermore, I follow this morning a very distinguished machine tool builder. Anyone who ventures to speak of machine tools in Mr. Flanders' presence is sticking his neck out.

I am reminded of an old European fable that goes back to medieval days, when tinkers wandered down the village streets soliciting the business of plugging holes in kettles and pans, which were very precious in those days. A couple of journeymen tinkers were going through an old Italian village one day, and they stopped. It was a hot day and the wine was good. One of them was a very tall man and carried his liquor very well. His companion was a little, short chap, who did not have adequate capacity under the circumstances for handling the situation effectively.

When they got through drinking, they resumed their plodding down the village street. The big fellow was in front, hollering, "Pots to mend. Pans to mend. Kettles to mend." About thirty feet behind him was the little fellow, crying feebly; "Me too, hic. Me too, hic. Me too, hic."

I need not explain the application,

MR. FLANDERS:

Nevertheless, you are the tall one.

MR. BERNA:

My obvious rejoinder to that would be a reference to your capacity, Mr. Flanders. I will refrain from that.

There is an outstanding characteristic of the machine tool industry that is very well known to those engaged in it, painfully known, impressed upon them by hard experience. That is the extreme fluctuation in demand.

The further you get away from the production of consumers goods the more likely you are to have that characteristic. When business is bad, people do still buy food--in lesser quantities to be sure, but the falling off in demand is not very serious, perhaps ten or fifteen percent. They

do buy clothing. Less clothing, yes. They make it do; they wear it out. The decrease in demand is perhaps on the order of twenty or thirty percent. But the man who has a manufacturing plant can get along with what he has. He does not buy machine tools at a time like that, because the outlook is uncertain. His demand is falling off. He can put to work in his shop the best equipment that he has and let the rest stay idle, thus conserving cash and reducing costs. The result is that when the market does not look promising, the demand for machine tools falls off very sharply, and there is a decrease in demand on the order of 70 to 80 or 90 percent.

That, gentlemen, is a characteristic that will have to enter into your calculations. It would be a very serious thing if we become involved in a major war at a time when the machine tool industry is flat. The volume in 1932 went as low as 22 million dollars. Of that, twelve million dollars consisted of orders from Russia. If we had become engaged in a major war at that time, the task of the machine tool industry would have been heroic, and perhaps we would not have distinguished ourselves.

In 1939 we started our part in this war. We got into it before anybody else did except the people who build airplane engines. We got into it because England and France saw disaster coming and needed American machine tools to produce airplanes of new types and in quantity. So we developed our capacity in 1939 and 1940. When our own defense program began, we were not caught with a depleted capacity.

That fluctuation in demand is a characteristic that also has a very decided bearing on what the machine tool industry considers essential government policies with regard to the industry. On that subject I would like to speak later.

Mr. Flanders has spoken of pool orders. I would like, if I may, to supplement what he has said, because we did find out in the last years of the war that pool orders were not favored by many very high-ranking officers in the Army. Their reason for that, quite frankly stated, was that it presented them with a rather embarrassing decision: "How can we say 'yes' to the machine tool industry when it asks for pool orders and say 'no' to people who make compressors or blowers or boilers or anything else in the industrial field?"

There are, gentlemen, two solutions to the problem of getting the machine tool builders under way.

First the Services decide upon a program. They want so many thousand shells of a certain size. Then they try to find contractors who will build those shells. Then the contractor goes out and consults his machine tool friends and gets competitive bids on the equipment he is going to need. And then, after he has gotten bids, he places orders with the machine tool builders. Not until then has this demand, which has been stated in very broad terms as so many thousand shells, become a specific task for this machine tool builder in his shop. He can not do a thing until it becomes a specific task.

Now, as soon as the Services have decided upon that program and started to look for contractors, it ceases to be a military secret, because of

necessity a great many people know about it. At that point the machine tool builders should be told what types of machine tools are required. If the Services still can not place pool orders for shell lathes, at least they can call down to Washington the people who make shell lathes and say, "Gentlemen, we are going to need so many shell lathes. We may be wrong, plus or minus a dozen machines or so; but that is about how many of them we are going to need. How many can you produce and when can you start to ship?"

If you can not give pool orders, at least the machine tool builder with his own money, on his own responsibility, can start building machines. If there is designing necessary, he can put his engineers to work on their drawing boards.

Gentlemen, one of the last shell programs that this Government engaged in was delayed three months between the time the Government decided upon quantities and sizes and began looking for contractors, and the machine tool builders got orders for the machine tools. That is an inexcusable delay.

The second method of getting machine tools and the best solution, as Mr. Flanders has said, is the pool order. The pool order policy reflects great credit on the officers that had it in charge. They did not miss their target by very much. The number of new machines produced that were not used was minute compared to the size of the program. That is to my mind a brilliant performance. It should be appreciated.

In reference to the control of the Machine Tool Industry I would like to endorse what Mr. Flanders has said: that Captain Henning's invention, "General Preference Order E-1-B", turned out to be a tremendous improvement over earlier methods. It is absolutely impossible in time of war, and especially in a major war, to make up a list and say, "This is the most important thing--battleships." Everything is important. It is like a chain. Which link in this chain that is under terrific tension is the most important link? They are all important. Captain Henning in that Preference Order neatly solved that problem by apportioning the output of each machine tool builder, as to each type and size of machine, to the demand for war purposes.

But along with this we must also have control of materials. Very early in the war Mr. Flanders fought that battle but was unable to impress the gentlemen in the War Production Board--at that time the Office of Production Management, I believe--with the absolute necessity of controlling raw materials. We have to control the flow of raw materials into the plant as well as control the dispersion of those products when they finally go out.

We have a control inventory. Gentlemen, you must realize when you deal with American industry you deal with people who have a great deal of experience and who naturally have developed certain habits of mind. It is considered good judgment, when a rising demand faces you, to cover your inventory needs. If you need sheet steel buy plenty of sheet, because the price will in all probability go up. You will not lose anything by it.

It simply means piling the stuff up somewhere where it is protected from the weather. But your production, the whole operation of your plant, will not be interrupted because you run out of sheets.

How badly that habit of mind serves us when we are heading into a war! We have a lot of purchasing agents bidding for more than they have to have, earlier than they have to have it. We create an artificial shortage of material.

The control of raw materials and the control of inventory are essential parts of a war program. We should have adopted controls years before we did in World War II.

Another form of control which broke down was the control in connection with the buying of machine tools by a contractor. Those orders had to be approved by a contracting officer. It was the tendency of the contracting officer who, after all, knew the contractor and was quite anxious to have him succeed, to cooperate with him. Certainly he did not feel qualified to argue with him on any technical points. The result was they purchased more machines than were actually needed.

The Machine Tool Industry very early in the war effort made a survey of 50 of the highest-ranking contracts on the Preference List. We found there just what you will find in any war effort: people bought more machines (to play safe) than they really had to have; they specified an earlier delivery date than the day they could possibly have used the machines. For an example, we had new machines pouring into a plant that, for six months, would have no sewer. We had machines pouring into a plant where the foundations had still to be put into the ground and where at least two months would be required before the machines could be brought in out of the weather and put under cover.

If we are not to waste machine tools at a time when they are as precious as blood, we must have a more exacting control of the buying of machine tools by contractors. We must also have a more accurate specification of the delivery dates. It is, especially in the early days of a war, a matter of cardinal importance.

There is also a disposition to buy too precise a machine. I am very glad Mr. Flanders brought that out. For instance, in an ordinary plant, we have in the tool room a machine we call a jig borer. Now a jig borer is designed for drilling or boring holes. It is an extremely accurate machine. We make it as accurately as we know how because, you see, any errors in the jig would be duplicated when we lay the jig on a piece of work and drill holes in the work.

There was one airplane plant on the west coast that ordered 40 jig-borers. Before the war, we hardly had 40 jig borers in the entire United States. They must have had a superintendent who, all his life, had wanted a jigborer.

There are many details in our effort where the other government departments, not the Armed Services, established policies that had a very

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direct bearing on the service we rendered to you. These policies did seriously interfere with the effectiveness of the machine tool industry.

The importance of the machine tool industry is not generally recognized. A few days ago we got Mr. Krug's report as Chairman of the War Production Board. If you have not seen it, just have a look at it. It is a magnificent piece of work. It is not only a good job of printing but it is also a fine report, profusely illustrated with curves, charts and graphs, tracing production in various key industries throughout the war. It also lists the number of each type of munition made during the war--information that is all the more interesting since it was, of course, secret throughout the war years.

Gentlemen, you will look through that book in vain for the words "machine tools." They are not even mentioned. Not once.

Consider the members of Congress--naturally they have a legal and political background (I am using the word "political" in its best sense; I am not in any way making fun of them)--they do not know anything about manufacturing processes or machine tools. When we go to them and say, "We have to have this; we have to have that. Your government policy hurts us," we are simply another guy asking favors.

Now in Germany--I am sorry I have to say a kind word for the Germans--they started out early in the Hitler era emphasizing machine tools. They adopted very drastic taxation policies which favored the renovation of their manufacturing plants. At one time they had this policy: At the end of the year, the gross earnings were divided into seven parts--one-seventh to be paid to the stockholders; three-sevenths to be paid to the Government as taxes; the remaining three-sevenths to be given to the Government unless it is used to modernize the plant. What do you think they did with the last three-sevenths?

Germany came into this war with more machine tools than we have today. Germany came into this war with magnificent metal-working plants. They were equipped to the eyebrows. They had it in 1939. We had not yet gotten there in 1945. They never, at any time, had to run their industries two shifts or three shifts. They ran them 10-hour days, six days a week, and had ample capacity. So that when one plant was smashed, they simply speeded up another.

Machine tools are important in time of war. I would be the last man in the country to say what is the most important thing. Fortunately, we do not have to make the decision as to what is the most important. But we do have to build up this industry. We have to keep it strong because it is an essential part of war production.

I have particular reference to Selective Service policies. I hesitate to express an opinion on this because you gentlemen are expert on it. But it has always seemed to me, personally, that our basic assumption was all wrong. We ought to take all 20-year-old men not engaged in an essential industry--I do not care where they live--instead of trying to assign certain area quotas, so many men must come out of this area in Cleveland; so

many from this area in Toledo. You see, there is a tremendous difference in the percentage of employment in essential industries in different localities. So that while we were out in Cleveland, right down to the bottom of the barrel in our Selective Service and Draft Board work, there were lots of young men in New York City, for example, who were not engaged in essential work; perhaps many were not engaged in any work at all.

Stemming from that basic fundamental assumption we got into a second problem, and that is what is "essential"? Early in the war we had a conference with a committee of the War Manpower Commission and the Selective Service organization. They were making a list of the essential occupations in the essential industries. They were good enough to include "machine tools" in the list of essential industries. But in connection with the list of essential occupations we could not agree with them.

I remember the first thing I hit, alphabetically, going down the list, was the complete absence of "demonstrators". As you all know, a demonstrator is a highly skilled specialist. Among other things, he understands his make of machine very well. We trained him very carefully and thoroughly so as to have a very good man on the tooling, operation and repair of just one type of machine tool. He has to be something of a diplomat also.

When we sent a new machine into a plant, we sent a demonstrator along. He made sure the machine was in good working order; that it had not been damaged in any way in shipment; that it was level; that it was all properly assembled; that it did not run backwards. He then talked to the operator and showed him how to operate this new machine. When the machine had been properly installed and everything settled, he went to the superintendent and said, "If you will check my report, I'll be leaving you."

Now you can imagine how important that man is in time of war.

Selective Service had a book containing definitions of various occupations. This book was produced by the Department of Labor. I do not know who did it, but it was an enormous job--a very good job, too. This committee said to me, "You know, Berna, a demonstrator is simply a person who displays; for instance, like the girl in the department store who shows women how to apply rouge".

Gentlemen, "demonstrator" is not included in the list of essential occupations in our industry today.

Twenty-one years of experience in the machine tool industry is nothing when there is a book.

I might say I also had an awful time getting "purchasing agents" included in the list. They said, "That is merely a clerical job". Well, I would like to have those gentlemen sit at the elbow of a competent purchasing agent for just one hour and see how "clerical" that job really is.

I would like to touch on still another thing and that is renegotiation. I think it must seem strange to you that any group of American citizens,

especially in time of war, with their own sons and nephews and brothers engaged on the fighting lines, can be so utterly devoid of patriotism that they would resist the recovery of excessive profits.

Now here we get back again to the wide fluctuation in demand. The machine tool industry, must of necessity set aside reserves in the good years to carry it through the bad years. When the demand falls off you not only have a loss of earnings, but we must redesign our machines in the bad years, and improve them so as to develop the market when it starts coming back. A percentage of earnings, which seems excessive in the tea business or shoe business, might be totally inadequate in the machine tool industry.

That is why the machine tool companies do not like renegotiation. It has been dominated by the Armed Services. They, of all people, should realize the things I am saying to you this morning, but they have just simply failed to realize them. It has been simpler to put all industries on the same basis; simpler not to have to make a distinction. The consequence is the machine tool industry has, in certain cases (especially in some of the small plants), been mulcted of money that should have been kept as a reserve against the future.

When the real impact of surplus hits this industry some of them are going to pass out of the picture. It is true we have a great many marginal companies that are not very big. But it is also true that some of these small companies do magnificent work. They produce a type of machine that is extremely important--not made, if you please, in large quantities, but made to a high standard of quality. We cannot afford to lose these small machine tool builders. As a matter of fact, the average size of the machine tool plant is small. The industry consists of small companies.

As to the machine tool reserve which the Armed Services are setting up, I would like to say that, in the judgment of the machine tool industry and its appropriate committees, that reserve is wholly inadequate. The Ordnance Department, in putting aside 11,000 idle machine tools, is setting aside the equivalent of approximately two weeks' output (at peak capacity) of the industry. The Air Corps, I believe, is revising its objectives. It had a list of 40,000. It is also setting aside certain key plants.

It seems to me quite obvious that since it is a relatively small industry and since it is a key requirement in time of war, that it is only the better part of judgment, while the opportunity is still before us, to set aside such an additional reserve that we will have at least a reasonable war potential to which we can turn in a hurry.

We may not have two or three or four years in which to get ready next time.

In connection with that war reserve, it is my suggestion, that we give attention to the very highly special machines needed in great quantity in time of war, but not needed or used so much in time of peace, such as a gun-boring lathe. You must have a lot of gun-boring lathes to fight a war,

yet I do not know of any industrial peacetime operation that resembles the boring of a big gun except it be the boring of shafts used on merchant vessels, or possibly the boring of a locomotive driving wheel axle. I think it would be difficult to improvise gun-boring machines or to find the in industry.

Shell lathes are another example. We do not have to have an awful lot of shell lathes, but we need them fast and we need them badly.

It seems to me that there should be a balanced reserve; there must be some of these highly-special machines; also many standard machines.

Gentlemen, I thank you very sincerely for your patience and appreciate the opportunity of speaking to you about some of our experiences in the machine tool industry during the war.

GENERAL ARMSTRONG:

Thank you, Mr. Berna.

Are there any questions at this time?

A STUDENT:

I have never gotten a really honest-to-God definition of what a die sinker is. Can one of you gentlemen tell me?

MR. FLANDERS:

I know what a sinker is. I know what a die is. But that does not tell you what a die sinker is. A die sinker used to be--and I do not know whether the term is still applied to it--applied to a certain special little machine which was built up in Hartford, in which there was a combination of drilling or milling, and then there was a little tool with teeth on the edge. Is that a die sinker, Mr. Berna?

MR. BERNA:

There are several kinds of die sinkers. It is a generic term which covers vertical profiling machines, milling and die shaping machines.

A STUDENT:

I am speaking of a die sinker that walks around--a man.

MR. FLANDERS:

He was a fellow who makes dies. I think when you use the term "die sinker" to distinguish a man from a die maker, you are using more or less a term in the jewelry or small hardware trade in New England. What part of the country do you come from?

A STUDENT:

I am glad to have the opportunity to tell exactly where I come from. There has been an extremely erroneous impression that I come from West Virginia. I came from east Virginia.

In talking to Mr. Howard, of the Howard Machine Tool Company in Cleveland, he told me that the die sinker trade was one of the most critical ones at the beginning of the war; that there were only two thousand of these individuals in the United States. I guess I should have asked Mr. Howard what one of them is.

MR. FLANDERS:

Yes. He probably was talking about a man who makes forging dies for drop forgings and things of that kind. That is what he was talking about, because that is the type of craftsman which got increasingly scarce in the United States. He is a little larger variation of the fellow who sinks dies up in New England for jewelers and a little smaller variation of those fellows up in Detroit who make dies for automobile tops, fenders and all the rest of it. But it is all really the same job. The real skill comes more in this medium and small work, particularly drop forging dies. Have I gone far enough?

A STUDENT:

Yes, sir.

MR. FLANDERS:

I am always glad to know when I have gone far enough.

GENERAL ARMSTRONG:

Mr. Flanders, is the present status of the machine tool industry better than you had anticipated it would be?

MR. FLANDERS:

This is the heavy statistician (indicating Mr. Berna). I have given the impressions and he can give you the figures.

Remember, as we were saying earlier, that it is not a single industry. It is a collection of a large number of builders of different machines of different types and sizes. I will first speak for my own company.

Anything that has to do with high-production machinery, such as for the automobile people, is in good demand. Anything that has to do with standard machines is practically dead. That is perhaps putting it a little bit strongly, but what we expected for the industry as a whole is true for standard machines so far as my own company goes, except that there is some foreign demand.

On the high-production machinery our own bottleneck is in engineers. There, by the way, is another war casualty. The Russians kept their engineers out of the Army. They even kept training them during the war. We have had five years supply of engineers cut off. Those that we had were to a very large extent taken into the Army. That is our bottleneck on production at the present moment.

We have a five-year supply on which to catch up. How we are going to do it and where they are coming from I do not know, because the process of training engineers for machine tool designing and production tool designing particularly, is a long process after they get out of school.

GENERAL ARMSTRONG:

I hope that the Manpower Committee will take note of that remark for use in their study,

A STUDENT:

I would like to address a question to Mr. Berna in regard to his remarks about the bad treatment that the machine tool industry received from the Price Adjustment Board.

I have heard some arguments in regard to the need for reserves advanced unsuccessfully by the shipbuilding industry. That also enjoys good times and bad times, mostly bad. It is my impression that, had those reserves been allowed by the Price Adjustment Board, we would have had trouble in retaining them, because of the taxes and the attitude of the Bureau of Internal Revenue which would permit the establishment of reserves only after taxes. I am wondering whether the trouble was all with the renegotiation procedures.

MR. BERNA:

Sir, the tax procedure is printed in books. You know just what you have to do. It is definite. It is fixed. You can plan on it. The procedure of the Price Adjustment Board is whimsical, secret, vague. You do not know how they arrived at their conclusions.

These reserves are after taxes. The money that we retain after corporation and excess profits taxes is still further reduced by the Price Adjustment Board. It is that "still further" reduction on what we think is a very unscientific basis to which we object.

A STUDENT:

It was my understanding that the Price Adjustment Board operated on your profits prior to taxes.

MR. BERNA:

Yes. They talk "profits prior to taxes". But what they take out of our pockets is what Mr. Vinson has left there.

A STUDENT:

I have one more question. Can you say what is the position of the machine tool industry today with regard to current reserves after this period of high production? Have you been able to establish any reserves?

MR. BERNA:

Yes. We have in some companies substantial reserves. In other companies we have little. The situation, of course, varies. Different companies have a different financial background and experience.

I might supplement what Mr. Flanders has said. When the Japs folded up, we had about 90 million dollars worth of orders on our books that had Armed Services priorities. Those machines presumably were all bought for the purpose of producing munitions. Only a third or less, 26 million dollars, were canceled in the month of the surrender and the following month, after which the cancellations fell off sharply. It was obvious that, while these current orders were apparently war orders, they were really bought with one eye cocked on the contractor's postwar program. That was not done improperly. I do not criticize it. But all of that business was considered to be subject to renegotiation.

I might add some statistics, since Mr. Flanders has referred to me as a statistician, which amuses me very much.

We are shy 55,000 college-trained engineers that would have been produced had the war not happened.

I might also add some figures on machine tool production. Our experience has been very much better than we anticipated after the war. We thought there would be a period of reconversion after the war during which we would get very little business. Our business has fallen off, but slowly. Our orders are still up to the level of 20 million dollars a month, which before the war would have been considered a very satisfactory, high level--above normal. Since the industry has expanded, it is no longer above normal volume.

At the same time I must also tell you that there are 24 to 30 machine tool builders who are desperately looking for work of any kind to keep their corporations going. Some six or eight are closing down for lack of materials or because of labor troubles. Others are busy and have a long backlog.

GENERAL ARMSTRONG:

Mr. Berna, is not what you say of the machine tool industry practically true of all the capital goods industries--that they are on a prince and pauper basis? Do you believe it would be feasible to have special treatment for the machine tool industry and get the support of all the other industries in the United States on such special treatment? I am merely

talking from the point of view of human nature, as I generally do down here. I think it must be considered.

MR. BERNA:

That raises a very nice question of policy, as to whether you are going to determine your policy on the basis of a popular vote. I do not know that that is the best way to run the Army and Navy.

GENERAL ARMSTRONG:

I do not mean the Army and Navy. After all, the Army and Navy are dealing with all industries. If the Army and Navy have some special favorites and it appears that you are granting special privileges to some, how is that going to be justified or how is that going to work? I am talking about it in the pragmatic sense.

MR. BERNA:

I think it would be a very difficult problem. The decision would have to be justified. There must be reasons for it. I do believe the other capital goods industries do share our characteristics to a greater or less degree. I do believe a ruling will have to be made not on machine tools, but on capital goods. I think the ruling will have to apply to those industries that have characteristics that enter into the equation.

GENERAL ARMSTRONG:

I was thinking of companies making locomotives.

MR. BERNA:

They have decidedly the same problems.

GENERAL ARMSTRONG:

They would come to us with the same problems?

MR. BERNA:

Yes, sir.

GENERAL ARMSTRONG:

I am in agreement with you. I am not arguing against it, because I think that you should have reasonable reserves. I think that our taxation should take into consideration its effect on national defense, which it never has in the past. The story you tell us about Germany and taxation directed to improving the security of the nation is something we have never thought of, I am sure.

MR. BERNA:

There is a feeling in the Treasury that when a man sets aside a reserve, he does it in order to avoid taxes that otherwise would have to be

paid by the stockholders who get that money; that it is in the national interest that the money be in circulation, to have people spending it and people buying things--a pump-priming consideration.

There is in the minds of industry a feeling that a reserve is a very special help in time of trouble. It may be used for wages, to improve the plant, or to advertise his product. It is an awfully nice thing to have. It is taxable, of course; but, nevertheless, we are still being penalized for retaining too much. The undistributed profits tax, that was repealed by Congress, is still applied by the Treasury, which still imposes an additional tax on sums which it considers in its own opinion is being set aside in excess of reasonable reserves.

The only untaxable reserves that we have are depreciation reserves, that is, the recovery of capital that has been invested in plant equipment. That reserve is set aside every year. It is really an operating expense on which no taxes are paid. But all these other reserves that we are talking about have been subjected first to corporation tax and the excess profits tax before we can put them into the bank.

A STUDENT:

In connection with reserves, not money reserves but physical reserves and machine tools, you mentioned rather briefly in your talk that, of course, in the years ahead we are going to have bad years and good years. Would you comment a little more fully on the feasibility and the practicability of building up physical reserves of machine tools during bad years, having in mind obsolescence?

MR. BERNA:

Sir, I think that if you could place orders for machine tools at a time when business is not good, and thereby sustain a high level of activity in the machine tool industry, it would be a very constructive move from our point of view and from the point of view of the national interest.

There are, however, obvious objections. In the first place, it is a subsidy. We do not like subsidies. Frankly, I think I am the only man in the United States who has sufficient moral strength so you can subsidize him without wrecking his character. Others do not share that view. But I do not like subsidies.

In the second place, money would have to be obtained through Congress. Money can be gotten out of Congress to employ people, but it is more difficult to get money out of Congress to buy things. It would be extremely hard to get money out of Congress in bad times for such things as buying machine tools for the Army and the Navy. We have been through this, gentlemen. You know what I mean. The whole spirit, the whole attitude, of the Congress, is opposed to that sort of thing.

But at the present time, here we are with thousands of these machine tools. Nobody knows how many, not even poor General Gregory. Mr. Symington

guessed that there are four hundred thousand; nobody knows. But there are hundreds of thousands of machine tools in the Services' possession. You have them; the Government owns them. Industry needs very few of them. It seems to me, then, that the proper thing to do would be to earmark those machine tools now.

They will be old style when the next war arrives, if it ever does. But we had some machines at Rock Island Arsenal in 1940. They were set aside after the last war, I think largely because they did not know what else to do with them. They were put in unheated buildings. They were not scientifically prepared for long storage. There was no money available for that purpose. They could not be very well maintained, because, again, it was not in the budget. They had money for sweeping the aisles in those buildings and no more.

When this war broke out, we took those old machines out of there and had them cleaned. Some of them are operating today. We can use them. They were life savers in 1941.

GENERAL ARMSTRONG:

What is the attitude of the machine tool industry toward shipping our latest machine tools to Russia? Is there any hesitancy in doing that?

MR. BERNA:

General Armstrong, I would say that in all of its dealings with foreign nations the machine tool industry has looked upon them merely as customers. I do not believe that ideologies have entered into the equation at all. We do not agree with the Russians in many things. We sometimes find it very difficult to deal with them personally, but they are potential customers. Our job is to sell to them and get our money if we can; and we do. Whether it is the Russians or anybody else, we feel that the foreign policy of the United States is something to be established in Washington, not by individual machine tool builders.

We take an order from the Russians with the greatest of pleasure. I do believe, however, General, that those tools are not well handled when they get them. They have lost a tremendous number of their trained men. They never did have as large a cadre of trained workers as they would like to have had. I think the wastage of machines in Russia at the present time is very rapid.

I do not believe that they have any enormous potential capacity for production of consumer goods that would flood the world markets or anything remotely resembling that. I think they are still very far behind in what they desperately need for building up their own transportation and communication systems, for producing consumer goods and housing, for their own people.

MR. FLANDERS:

I would like to say a word on that subject. I think every machine tool builder who has sold machine tools to Japan in any great quantity looks

back on what he did with a great deal of disquiet. He rather wishes he had not. And yet, after all, the responsibility lies with the State Department. That is where the responsibility lies.

I do not believe we are justified in making individual decisions with regard to those things, because there were times in which the State Department actually wanted this country to be in the position of sending things to Japan. They apparently were working for time. That was more or less definitely stated when we made inquiry of the State Department about sending stuff over there. The State Department does have to take the responsibility. While we may regret that it happened in the way that it did, the responsibility, after all, is not ours, so far as we can see.

GENERAL ARMSTRONG:

Gentlemen, I think that we shall discontinue the questions here. I want to thank the two speakers for their contribution to our work.

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