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MACHINE TOOL PRODUCTION

3 February 1953

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Publication No. L53-89

INDUSTRIAL COLLEGE OF THE ARMED FORCES

Washington, D. C.

1272

Mr. Tell Berna, General Manager, National Machine Tool Builders Association, was born in Pelham, New York. He was graduated from Cornell University in 1912, with a degree in Mechanical Engineering. He recently completed a term as trustee of the University. Mr. Berna received his first training in the electrical industry with the Cutler-Hammer Company, for whom he was a branch manager in Cincinnati for seven years. His experience in the machine-tool field covers some 31 years; successively as sales manager for the G. A. Gray Company, builders of planers in Cincinnati; general sales manager, National Acme Company, manufacturers of multiple spindle automatic screw machines and die heads. He has been in his present position since 1937.

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COMMANDER ENGLISH: Gentlemen, we recently heard machine tools referred to from this platform as machines that make machines. It is also true that machine tools are the basis of our mass production. Without them we could not have large-scale military preparedness programs. This small but essential machine-tool industry has always suffered from our vacillating policy in military preparedness, and it has periodically endured a feast or famine existence.

The Vance Committee Report, of which you all have copies, describes a healthy machine-tool industry as the key factor in this Nation's ability to maintain an adequate mobilization base.

Our speaker this morning is Mr. Tell Berna, who has been General Manager of the National Machine Tool Builders Association since 1937. I am sure he must have felt that his was the voice of one crying in the wilderness when he was pleading with industry to keep its machine tools up to date. I am also sure he is encouraged by the increasing recognition by industry and the Government of the importance of this problem.

I am happy to welcome Mr. Berna back to the Industrial College and to introduce him to you to speak on "Machine Tool Production."

MR. BERNA: Good morning, gentlemen. The text for this morning's sermon will be taken from Fred Allen's law, which is: "Things are always much more complicated than people think."

We have unfortunately a very small industry, an industry that is essential to the welfare of the Nation in peace as in war, a very complicated industry. Sometimes I think our friends in Washington get tired of us when they find out how complicated the machine-tool industry is.

In the first place, when we started out building machine tools a century ago, a man would use a machine tool for his purpose and adapt it and change it. If he had a job of boring to do, he would makeshift to do it on his engine lathe, although an engine lathe is not intended to be used for boring.

When I was a kid, they would rig up what we called an "old man," a way to use a machine for something its maker never intended. That is expensive; it is time-consuming. We can't afford it nowadays.

There has been a very decided trend in the last 50 years toward designing a machine for a specific operation on a specific piece of work, and to make it as automatic, as possible. I have to qualify that. A general-purpose shop, a jobbing shop, can't do it very well.

If you go through plants, you find sometimes that what we consider a general-purpose machine is equipped with special tooling. We don't call it an "old man" any more. It is adapted for that operation by the machine-tool builders in order to get maximum output per man-hour.

You see how that complicates matters, because, instead of simply turning out large quantities of a few basic types of machines, we can't ship the machines until we put tooling on them. Tooling has to be made in the toolroom. That means expensive labor, difficult to recruit, and takes years to train.

While we are speaking of machine tools, may I impress on you gentlemen that we are conscious, as no doubt you are, too, that a machine tool does not operate in a vacuum. Equally important with the machine tool is the building, ventilation, heat, light, conveyors, hoists, cranes, fixtures, tools, and gages. Those are things of infinite variety. A most important item is the gage. Unless the operator checks his work, he may produce a good deal of scrap before you catch him.

We have divided machine tools, for the sake of explaining them to our friends, into six major families, or arts of cutting metal. I think it is a useful device.

1. We have the milling machine family. It has a rotating cutter with teeth on its periphery. As it turns, it generates a flat surface or a shaped surface on a piece of cast iron, steel, brass, or aluminum. Milling machines range all the way from the little metal-cutting machine you see in the toolroom up to the enormous planer type milling machine with a table 10 feet wide and 40 feet long, with four milling heads. A milling machine may require a 5 horsepower motor or a 100 horsepower motor.

2. Then we have the grinding family--an important family for correcting error. If a piece is heat treated, we get some change in the shape or diameter. If it is heat treated for hardness, it is probably too hard to work on with a cutting tool, so we use a grinding wheel. In the grinding family we have everything from the little floor stand used to sharpen cutting tools to the cylindrical grinding machine for turning steel mill rolls.

3. Surface grinders have come into increasing use for grinding flat surfaces.

4. Then we have the family of planers, shapers, slotters, and broaches. On the planer we strap a piece of work to the platen and the tool generates a flat surface. The machine is capable of doing work to extremely close limits of accuracy. When I was with the Gray Company in 1919 we built a lot of 24", 30", and 36" planers. I was in that plant last week and the smallest machine was the 36". The biggest planer was 14 feet between housings. It is intended to machine a casting 14 feet wide and 30 or 40 feet long, depending on the length of the table.

5. Broaching machines are relatively new. They may operate in either a horizontal or vertical plane. As the broach moves across the piece, each tooth of the broach takes a little, tiny chip, perhaps two thousandths deep. The last tooth which passes over the piece, leaves it to finished dimensions. Obviously the broach is intended for pieces where there is not very much metal to be taken off, and there are many identical pieces needed. It is used extensively for knuckle joints on automobiles and for things of that sort. It is faster than milling and has a very definite place in the scheme of things in the defense program.

The biggest broaches are those used for automobile engines. You drop the block of a V-type engine on a conveyor and it automatically moves to a certain position. It is there clamped automatically in place and a huge broach which may be 12" wide and 10 feet long swipes across the top of that casting and finishes the entire top surface of the block. It then moves automatically to a mechanism that turns it upside down and presents the surface of the bottom of the engine to another huge broach. When the block comes off the conveyor, you have finished the top and bottom of the casting.

6. In the turning family you are all familiar with the lathe. The lathe has many forms. I have a list here of the major types of bench turning machines. I want to read it to you. It is not important, except to give you an idea of how very complex each of these major groups of the machine-tool industry becomes. We have the plain bench lathe; screw cutting; light duty engine lathe; toolroom lathe, light duty and heavy duty engine lathe; toolroom and toolmaker lathe, floor type; heavy duty manufacturing and production lathe (not automatic); automatic form turning lathe; gap bed removable block type lathe; gap sliding bed type lathe; hollow spindle lathe; turret lathe (not automatic) bench and floor light duty; turret lathe ram type plain; turret lathe ram type universal; saddle type turret lathe; saddle type turret lathe with cross sliding turret; saddle type flat turret, fixed center lathe; saddle type, flat turret, cross sliding headstock lathe; automatic between centers chucking lathe; automatic bar machines, 4, 5, 6, 8, and 10 spindle; automatic vertical 6 and 8 spindle lathes; boring and combination boring and turning lathes; double end boring lathe; combination boring and turning lathe; axle lathe; crankshaft lathe; shell lathe; cartridge case trimming and head finishing lathe; right angle lathe; spinning lathe; relieving lathe.

Of each of these, there are many different sizes and a myriad of modifications, tooling, and attachments. So you see Fred Allen was right. When we get into a defense program, it is no use saying to a man: "Here is a toolroom lathe," when he needs an engine lathe, and there's no use saying to him, "Here's an engine lathe" when he needs an axle lathe. For turning a shell, you need a machine designed for turning a shell. You haven't time to fool with adapting a standard machine, which is too light for the duty anyway.

Another characteristic of the machine-tool industry that is extremely annoying is the extreme variation demand to which Commander English has referred. That is due to human nature. I don't think we will ever get away from it. When an industrialist sees a good market ahead and when things look promising, he has to expand his production and he thinks first of all of increasing production by adding to his machine tools and by modernizing his equipment. Unfortunately, he gets the signal at about the time the rest of the industry does and everybody wants machine tools at once. As soon as he is able to produce on the machine tools, he will reduce his costs and increase the accuracy of his product, which will therefore enable him to meet a competitive market successfully. So he not only wants machine tools, he wants them before his competitor can get them. The plight of an automobile builder who faces competition on the new type engine on some other automobile and can't get the equipment he needs to tool up for that new engine is a painful thing to behold.

Conversely, when we hit a 1929 or a 1938 and there is a falling off in consumer demand and everybody gets the idea the picnic is over and they are in for trouble because business is not going to be so good, they think they can always keep their shops running, they don't go out and buy machine tools at a time like that, but they keep their money in the bank. They feel that the best friend they have is money in the bank and they are going to hole in and see how things are going to be. They keep the machines they have. That's exactly the wrong thing to do.

Nevertheless, the fact remains that machine tools don't wear out. Some years ago we wanted to set up a display at the Museum of Science and Industry at Chicago. We thought the best way to show the development of design of machine tools would be to have four lathes in a row, because people know something about lathes. We got the oldest lathe we could get. We got one that was built in 1890 and one that was built in 1920. Then we borrowed the last word in lathes from one of our members. The oldest lathe was built in 1821 by a man named John Wilson, whom you probably don't remember. He built lathes in Providence, Rhode Island. This lathe had a wooden bed, made out of large pine timbers and wooden legs. The lathe ways were cast iron with a filed surface, beautifully done. It had a geared head and a tailstock.

For his toolroom he had a panel fastened to the rear of the lathe with nails on it for the tools. If he needed a tool he reached over for it.

That machine was in operation in a garage in Provincetown, Massachusetts, when we bought it in 1937. It could be run at that time.

All you have to do for machine tools is to oil them, repair them occasionally, and adjust them.

People say, "The outlook is not too good. Well, we will keep what we have and wait to see what happens until the market comes back."

I have said that is the wrong thing to do. At a time like that you can get more careful attention from the machine-tool builder and more vigorous competition for your orders than you get when orders are pouring in. The best defense against a depression is not money in the bank; it's low production costs, because your assets in the bank can dwindle fast when you are operating at a loss. When you are tooled to do a better job than your competitor, you don't have to operate at a loss. You can get more than your usual share of what business is being placed by modernizing equipment and cutting your costs.

American industry usually accumulates obsolete equipment year after year until a war comes along. Then it devotes its entire energies to production for defense and it gets a lot of new equipment. When the war is over, it retains much of that equipment or buys machines out of surplus. (As a nation, 43 percent of our machines were over 10 years old at the end of World War II.) Then we sit back and obsolescence again begins to accumulate until another defense program comes along. Then we clean house again.

Our first line of industrial defense is the government arsenal or the government shipyard, properly tooled. People know how to make munitions in those plants; they have experience and training; everything is there.

Our next line of defense would be a stand-by plant, of which, at the moment, I don't think we have any--a twin-purpose plant. That is the basic idea, as I get it, in Mr. Vance's report.

Let us take for a moment, for example, the Hoover Suction Sweeper Company. Nothing could be more remote from weapons than the Hoover suction sweeper. We go to Mr. Hoover and say, "We would like to have you make a fuse body. How many machines do you have that could be adapted for the manufacture of a fuse?" He happens to have a great many multiple spindle bar machines, also a toolroom, engineering skills, administrative skills, production skills, and cost accounting of a very high order. Let's say that there are some 86 machines he doesn't have. Suppose we

say to Mr. Hoover: "You put up a plant on your property, the Government will pay for the plant. We will install in the plant those 86 machines. When we give you the signal, your men will proceed to retool the multiple spindle bar machines; they will go into that auxiliary plant and you will be in the fuse business." How long would it take Mr. Hoover to change over? A matter of hours.

Let's go a step further. Let's say to them, "We want you to run that plant one day a month." We accomplish several things. In the first place, we get the "bugs" out of the equipment; we find out what's wrong with our 86 machines, if anything. We check his gages. We check the product and know that it is right. He can make this product to the standards of the Defense Department, to the accuracy and tolerances, and out of the right materials. Most important, we got fuses, and fast.

As Mr. Vance points out, we can reduce the number of tanks we are making. Every four tanks not made is a million dollars we can put into tank capacity. We can't hope to make enough tanks to take care of the needs of modern war anyway, and we have no place to put them. We have to leave them out in the weather and they deteriorate. But we can install increased capacity for making tanks. Even though you change the design of the tank in some detail, we can commence producing tanks in very short order. While you might have to scrap some tooling, and replace it because of design changes, the plant doesn't become obsolete as fast as the tank itself.

Your next line of defense, and it is a mighty one, is the metalworking industry of the United States. It is, as you know, the greatest metalworking industry on the face of the earth. It has plants that can do almost anything. When you come in with your defense needs, you will find that they are not what the plant has been making, but the men in the plant being engineers are adaptable and can, without too much schooling, swing into the manufacture of your weapons. Take the AC spark plug--can you think of anything more different from Oerlikon guns than that? Yet in World War II they made Oerlikon guns and made very good ones.

There can be a delay in producing weapons if you have an ally holding back the aggressor, but who can give you assurance that you will have X months to prepare in World War III?

So you see, it is very important to you gentlemen and to the American people that the metalworking industry be properly equipped with machines, so that you don't come to this little machine-tool industry (at the moment we have 66,000 wage earners in the entire industry--there are single plants in the United States with more than 66,000 wage earners in other industries) to with the combined demands of the defense Department and of the contractors who are to produce weapons for modern war. They need enormous numbers of machine tools and they overload the industry.

Oddly enough, the most wonderful accumulation of obsolescence in the country is in the automobile industry. A survey made by the "American Machinist" in 1950 disclosed that the American metalworking industry replaces 2 percent of its metalworking machines every year. That is one turnover in 50 years. I need hardly say that we make improvements in design faster than once in 50 years. The automobile industry turns over its equipment once in 100 years. That's a startling thing. You and I think of the cars coming out with new V-type engines. They have bought new production lines for those engines. But the machines that make the steering knuckles, the shafts, and the bolts and nuts which go to make up the rest of the automobile are getting older.

They are not giving any trouble. That's just it. It would be better if we could build machines with time fuses so that they would blow up at the end of 15 years.

Again we are up against that basic handicap--human nature. If a man who is running a plant walks by a machine that is functioning, he gives it no thought. He has plenty of places where things are not functioning; he has plenty of problems. If he could replace that machine with a new one, at the rate of 4 percent amortization, the new one might pay for itself in two or three years.

There is no simple rule. You can't say that when a machine is 10 years old it is obsolete; that is not always true. You may be doing work on a machine for 20 years and it may be as good for that job as a modern machine would be. You have to find out what the new machine will do, what the cost is, what the rate of production is on the new machine as compared with the old machine. You have to figure that out. It is not difficult.

But the attention of the works manager is not devoted to that. What we have to do is a selling job. We must convince our customers that productive equipment must be checked, because otherwise the user is losing a potential profit. A machine that is giving no trouble may nevertheless be a source of loss.

When it comes to the development of capacity, the suggestion that we get most often down here in Washington, as soon as somebody finds out the machine-tool industry is inadequate, "We will take the industry over." We will pass that one by.

The second suggestion is that we take a half-billion dollars, build a lot of machine tools, put them in warehouses, and then we will have them. That sounds reasonable enough, if you have the money. Let's think of that a moment. I told you about the amazing complexity of this industry. To make matters worse, a defense program requires a "mix" different from that of peacetime production. We have a relatively small

demand for horizontal boring mills in peacetime. In a defense program you need them by the dozens. Other types of machines have not been in great demand in the defense programs but are normally produced in substantial quantities. You need different types of machines, not just an enormous number of each and every type.

That's like the man going out to work. His wife straightened his necktie, gave him a dutiful peck, and said, "When you are coming home, you might bring home a remedy." He said, "A remedy?" She said, "Yes; medicine." He said, "What do you want the medicine for?" She said, "Oh, to have medicine in the house. You never know when we will have illness." He said, "Listen, woman, there are five thousand items of medicine in the drug store. Which one of them do you want me to bring home?" She said, "Never mind that, just bring home some medicine."

That is what we would be doing if we bought machine tools and put them in warehouses. It cannot be done that way. We had about 130,000 machine tools in the National Industrial Equipment Reserve at the end of World War II. May I impress on you gentlemen that they were not selected. They were laid in the lap of the Defense Department. They were the dregs, the sludge--what was left over from World War II that the War Assets Administration had not disposed of. Nevertheless, every one of those machines was the property of the United States Government because it had been needed for a defense purpose. And in spite of the fact that in the Korean war in this present defense program the machine-tool industry got 23-1/2 months behind in shipping defense machine tools, there are some 35,000 units still warehoused that could not be used.

Now, to be sure, some of them are in pretty bad shape. But you have made changes, you see. You don't want a lot of reciprocating airplane engines; you want a lot of jet engines, which take an entirely different line of machines.

It would be simple to buy machine tools and put them in warehouses. But that is not the answer.

Is there something the Government can do? I suggest to you, and I think every one will agree with me, that any form of subsidy should be regarded as the last desperate expedient. I cannot speak for other industries, but I can say this about machine-tool builders, and I have been in this business most of my life: The thing that has made the American machine tool pre-eminent in the world markets has been competition--the fear of loss and the hope for gain. A machine-tool builder redesigns his machines because he has to, if he is to stay in business.

Our new designs come from Bill Williams in a plant up there in Detroit; he makes a self-starter for automobiles. He calls the machine-tool builder in and says, "I have to make this at so many an hour. It

costs 18 cents and I have to get it down to 12, or I won't get the contract with the automobile company." The machine-tool builder has to think up some way of doing that for his customer. What is more, after he builds the machine he has to demonstrate it in the customer's plant and show that he can produce the piece in the time required before the machine is paid for.

That makes for research and design; it makes for progress. That is the drive, the vigor, in the machine-tool industry which we would lose as soon as you tell the machine-tool builder that no matter what happens he will get enough business to keep his doors open. There would be no more progress, human nature being what it is.

There are things the Government can do that are most constructive, I would say, in the way of removing unnecessary obstacles from the continuing advancement of the industry. They are good things for other industries, too.

I would throw the excess profits tax in the ash can. Before you can determine what excess profit I have earned, you must determine what my normal profit is. What is a normal profit in an industry that has no normal? How can we assume it was normal in 1946 to 1949, when the machine-tool industry was enjoying a little depression all of its own?

We must permit industrialists to recover the capital invested in manufacturing equipment in a shorter period of time. That is one reason why they don't buy modern machines. The United States Treasury says that the life of a machine tool ranges from 15 to 25 years. As a matter of fact, if a better machine is designed in the first eight years, the original machine ought to be replaced--I don't care what condition it is in. If you can make money by replacing it, you should replace it. The business of the machine-tool user is to earn a profit. Nobody ever bought a machine tool for any other reason.

Our depreciation policy lags behind that of other nations which have permitted capitalists to recover their investments in machines in a much shorter time. In England they recover over 50 percent of the cost in 12 months.

Government labor policy ought to be revised. That is not just a machine-tool problem; that is an American industrial problem. It is perfectly ridiculous to give to a small group of labor organizers absolutely unrestricted power, so that any one of 15 or 18 men can bring production to a halt, in peace or war, without penalty. It is an extremely dangerous situation with which to enter into a major war.

Another thing that the Government can do is to avoid, so far as possible, the application to the machine-tool industry of regulations that are not adapted to the problems of that industry. Right now, for instance, we have a problem with procurement officers trying to use standard procurement stipulations for everything they buy. Some of them are not suitable for the purchase of machine tools. The procurement officer finds he can't place his order, he has a series of discussions with the builder, and finally reaches a compromise which the machine-tool builder will accept. But that takes several months. You won't have several months for that sort of waste motion in time of war.

Just a few days ago, the Milwaukee office of the Air Corps told one of our members that he should submit a written report on his quality control. He said, "I haven't time to write a book on quality control. It is all over my plant. I can show it to you, but I have no time to write it up." After several weeks of discussion, they withdrew the demand.

I might make another suggestion. This would be addressed to every government department. It would be a good idea to put regulations in the kind of English that is used in industry.

Now, if I have given you the impression that this machine-tool situation is an insoluble problem, gentlemen, I have not stated the case accurately, for it is not. There is nothing in our picture that can't be solved by persistence and good will. If I have given you the impression that we are insisting on your doing business on our terms, I didn't mean to do that. I assure you that the American machine-tool builder is just like any other American citizen. He has a son in the Army, a nephew in the Air Corps, a brother in the Navy. He is in this just as deeply as you are. Certainly, the machine-tool builder knows, if anybody in the United States knows, the connection between what he does in his shop and what happens in Korea.

COMMANDER ENGLISH: Gentlemen, before we start the question period, I have an announcement to make. I see Colonel Morrow in the audience. He is working on the Air Force heavy press program, which I have learned is now the subject of an exhibit being held in the Pentagon. This exhibit will last until 10 February 1953. There are movies and illustrations of 25,000 to 50,000-ton forging presses and 8,000 to 20,000-ton extrusion presses. You can get in touch with Colonel Morrow if you want a detailed tour of that exhibit.

That brings up the point that we have the Air Force heavy press program, and Mr. Berna didn't mention that. I wonder if you would want to say something of the particular problems of that program before we start the questions, Mr. Berna.

MR. BERNA: Thank you, Commander. It has occurred to me that I didn't include in my families the drilling and boring family, which is also very important.

Then too, in the press group we lump together the forging machines, horizontal and vertical, the bending brake, and the mechanical or hydraulic press. There, of course, is an infinite variety of these metal-forming machines.

The small punch press, or the open back inclinable press, is a staple article in a metalworking plant. They are all over the place. But the very large presses the Air Forces need are not available in private industry.

There has been a great deal of interest in these very large extremely powerful presses, like the one we obtained from Germany after the war. The difficulty we get into in the construction of these large presses is that the force we exert on our aluminum forgings becomes a tensile strain on the tie rods that hold the top of the press to the bottom of the press. If you look at the presses they use for stamping bodies at a Fisher Body plant, you can see that they may be 20 feet below the floor and go up in the air about 25 feet. That is a big piece of machinery, but it is not big enough.

When you go beyond them to the enormous presses Commander English has just mentioned, the four tie rods at the side of the press become so large that nobody can forge them or turn them, nobody can transport them. One solution is to make them laminated; in other words, take steel plates and stack them up side by side until you get a tie rod eight feet one way and four feet the other. That costs a lot of money. The Austin Company of Cleveland, not machine-tool builders but puts up shops and factories, got together with the Hydraulic Press Company and dreamed a dream. It has not been built as yet but it has great possibilities. Its idea is to make the whole thing out of concrete--make a concrete platen into which is imbedded your anvil, or the lower part of your press, the bolster plate, and the lower die. Up above you have the hydraulic cylinders. The whole thing is supported in an enormous frame of reinforced concrete. The upper part of that press weighs so many tons that even if you push down 100,000 tons, there is no tensile strain on the side of the press, because the head weighs more than 100,000 tons--very simple and price about 25 million dollars.

COMMANDER ENGLISH: Mr. Berna is ready for your questions now.

QUESTION: How does our machine-tool industry compare with the foreign machine-tool industry, the German, particularly?

MR. BERNA: Before the war our industry was the largest in the world and compared favorably with the aggregate of Europe and England. Today they have three times as much machine-tool industry as they had before World War II. Most of this is on the continent. This expansion has arisen from two major sources.

One is the determination of the ECA and now of the Mutual Security Administration to expand industrial production in Europe, and they have done a good job.

The English have expanded, but not so greatly as the French, Germans, and Italians. The German industry has come back with a rush. A German machine-tool builder who slips out of East Germany with nothing but the pants he is wearing can go the the bank, borrow money, get a barn, hire men, and get back to work. He can equip his plant with new machines, including American machine tools. Actually, the German machine-tool industry is today better equipped than the American machine-tool industry. The Germans pay about 45 cents an hour, and there is no nonsense about time and one-half for overtime. They may work 65 hours a week. There is an enormous pool of unemployed, so there is no labor trouble. They get a rebate from the German Government for every machine shipped out of Germany. The French machine-tool builder gets an even larger rebate--14 percent. That practically pays the duty on his machines arriving in New York, which is 15 percent.

Twenty-five percent of our output used to go to Europe. It is now down to 6 percent. Imports of machine tools into the United States used to be 2 million dollars a year. They are now around 50 million dollars a year. I haven't heard any machine-tool builders suggest that the duty on foreign machine tools should be increased. They would rather rely on competition. They feel they can win in spite of the price differential. In other words they build better machines. They put better material into them; they use alloy steel ways instead of gray iron. Their machines may not be painted as nicely, but they have 15 horsepower motors, where the Europeans use 5 horsepower. The European machine is built for the European market, where labor is cheap and materials are expensive.

Production is the only constructive answer to the inflation from which these nations are suffering. If you talk to them about, they say, "You fellows have mass production; we have not." Actually, we do not all have production in this country. The average number of workers in an American metalworking plant is about 92 men. We stress output per man-hour; our wage rates are higher. If we don't stress it, we go out of business. It is as simple as that.

The answer is competition--except that we are blocked from the European market in many places. We can't sell a machine into Switzerland,

for instance, if it is of a type made in Switzerland. We can't sell a machine in Australia; we can't get an import permit if they can't get it in Australia or in the British Empire. We have reciprocal trade treaties, but that seems to be a one-way street. What we ought to do is to say, "Well, gentlemen, we will not permit your machine tool to come into the United States if it is of a type made in the United States." Maybe that would induce them to look at the thing in a more impartial way. There is a dollar shortage, to be sure, but I am talking about the many cases where the customer can get dollars.

There are delivery problems. Our deliveries are sometimes extended, although right now they are pretty good. It is evident that most foreign metalworking plants would give their right hand to own an American machine tool. They have the same feeling about American machine tools that you have about Parisian perfumes or English leather goods. Say it is a bias or a prejudice, but it is there. One of the nicest things that happened to me was when I had an opportunity not long ago to go through a factory in Paris. They showed me a French lathe and a German boring mill. Then the manager took me around the corner and showed me with great pride a planer made in the United States. It was the apple of his eye.

You see, I go back to what I said before. What we want from the United States Government is not a subsidy. What we want from our Government is to please get out of our way.

COLONEL CAVE: Mr. Berna, I wonder if you will comment on this problem. In trying to standardize some of our materiel ally-wise, we ran into an interchangeability problem on American production and European production. Will you comment, please, on the machine-tool aspects of that problem? Does the fact that they are made on a European-built machine make these things interchangeable with our own? Are there any aspects in the transformation?

MR. BERNA: There is no reason at all why the products of a European machine-tool builder should not be physically interchangeable with the products of American machines, unless the machine tool cannot meet the limits of accuracy you gentlemen ask for. There are not so many different types of machine tools in Europe as there are in the United States. That rises from the extraordinarily large variety of metal products made in the United States and from the exacting demands of our customers.

However, there are many excellent machines made in Europe. I think you will find that if a weapon is produced in Europe, the man-hours would be more than in the United States. On the other hand your cost per hour would be less; so you should come out at about the same cost per piece.

While the foreign machine tool might not be built to American design--although many of them are copies of American machine tools--the pieces produced should be interchangeable.

But in that connection, gentlemen, may I make one comment which is off the subject, perhaps? One of the most expensive things in our life is a zero. The difference between a tolerance of point .001 inches and point .0001 inches is one zero. It may run into thousands upon thousands of dollars. It is an easy thing for a designer sitting at a drawing board to have some fun by calling for an accuracy of a tenth when he should say a sixteenth. We have found some parts made to a close limit which were then given a coat of paint. We have that problem throughout industry.

We have another problem that perhaps you know of--that is the insistence on a certain alloy. The steel has to be SAE 6230--nothing else will do. That costs a lot of money. One of our members buys 600 different compositions and shapes of alloy steel when he builds machine tools. That could probably be reduced to 100. This is something that has been the outgrowth of the vigorous and astute salesmen of the steel companies. It is absolutely nonsensical. When we had to go to the national emergency steels in World War II we knew the machine-tool industry would collapse. We went to the national emergency steels and we have not collapsed.

QUESTION: I have a little difficulty understanding why machine tools which might be kept in a warehouse for stand-by purposes would become obsolete more rapidly than machine tools in a stand-by plant.

MR. BERNA: That's a good question. They don't. It doesn't make any difference whether the machine tools are still in line or are in a warehouse, so far as obsolescence is concerned. They become obsolete for one of two reasons: in the first place, because better machines are designed to take their place. I think if you get into war, these machines are not so efficient as they might be, but that doesn't necessarily keep you from producing weapons. The other reason is that you may change the design of a weapon, the machine should be bigger or have entirely different characteristics.

The objection to putting machine tools in the warehouses is the physical depreciation through condensation. The Navy knows how to store machine tools. It has done a fine job. We hope every one will eventually be able to do it the way the Navy does. It stores them in dehydrated tents. You don't have to get completely dry air. You don't have to heat the warehouse. You take the air out and put it through hygroscopic material. You keep the air circulating. These machine tools will deteriorate, but almost imperceptibly. The only deterioration seems to be in the antifriction bearings.

If you take machines with antifriction bearings, which have balls or rollers, and put them in a warehouse, when you take them out you can see that where every ball has been resting on the race it has made a tiny hollow, two or three ten-thousandths of an inch deep. When you want to use the machines, the bearings are noisy.

The objection to putting machine tools in warehouses rises from other sources. It takes time to go to the warehouse and find what you want. The machine is difficult to identify. It has been greased all over and the light is bad. You take it to your plant and steam it off and fix it up. Then you need repair parts. You put tooling on it. Then you have to install it and put an operator on it and train him. Then you get production.

How much more desirable it is to have a stand-by plant where the machines are installed and where the operator has operated the machines. All he has to do is walk out of one department into another. That is not possible when the machines are put in warehouses.

QUESTION: In the matter of making products for the armed services, we have been informed that a great many of the modern weapons are so intricate and require such tolerances that the producers are having a terrific time getting the machines to make the things down to the tolerances and simplify the operation so that they can turn them out in mass production. How closely does your machine-tool industry work with the producers of weapons of war to perfect the machines to make the machines?

MR. BERNA: That, Colonel, depends. Properly speaking, the defense contractor is our peacetime customer, too. If Buick gets a contract to make engines, it knows everybody in the machine-tool industry. It has been buying machine tools for X years. It is difficult to be sure, because you are asking Buick, your contractor, to tool up for something it never saw before. Buick runs into troubles that it didn't anticipate. It is true that the designer can put something on the board which the shop man can't make. He may not know how to machine this piece to the degree of accuracy required.

We do work to extremely close limits on some peacetime products, but a defense program reeks of accuracy. We never had anything like the reciprocating airplane engine in peacetime industry, unless it was in the manufacture of gages. Dimensions quite commonly at that time had to be held to tolerances expressed in tenths or thousandths. On your reciprocating engine a minute scratch would lead to discarding a piece.

You have to give the production men time. They have the close cooperation of the machine-tool builders. That's the only way to get the job licked. Then it comes along quickly. What seem to be unsurmountable

production problems yield to pressure and production begins to flow. When we started out with the jet engine, we were using vertical boring machines for the turbine discs. But only a few builders make them. Then somebody went back to the middle of the last century and thought of a lathe where you have a bed at right angle to the spindle. Any one of six or eight builders can furnish them. The new contour turning device that has been developed makes it a rapid operation. While you present to us a great many new problems, they will yield to cooperation. I don't think there's any difficulty in cooperation between the machine-tool builders and the defense contractors. I haven't heard of any.

COMMANDER ENGLISH: Gentlemen, let's cut the question period off here as there will be a seminar with Mr. Berna this afternoon. Thank you, Mr. Berna.

MR. BERNA: Thank you, gentlemen.

(26 Mar 1953--750)S/rrb.