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MACHINE TOOLS IN WORLD WAR II
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Machine Tools in World War II--Captain E. R. Henning, USN

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CAPTAIN HENNING:

The three basic elements of production are raw materials, plant equipment and manpower. Management accumulates the raw materials, provides the plant equipment, and organizes the manpower in skills or "know hows" by which it fashions the raw material into the multitudinous products of modern mechanical civilization. The raw material may be cast into shapes, forged, pressed, extruded or as cylindrical bar stock, directly machined. These operations are accomplished by molds made from patterns, rolling mills, forging hammers, presses, bending rolls and machine tools. The resulting parts depending upon the complexity of design, are assembled by bolting, screwing, riveting or welding.

The one element common to this entire production process is the machine tool. If it does not machine the part, then it is necessary in the production of the equipment used to produce the part, the press, the roll, or the wood working machinery to make the pattern. It is unique in that it reproduces itself. Machine tools are made by machine tools. Its technical definition is a machine that removes metal by chips. It accomplishes this by rotating metal against a cutting tool as in a lathe, rotating the cutting tool against the metal as in a milling machine or drill press, or moving the tool longitudinally against the part to be machined as in a shaper, or the metal longitudinally against the tool as in a planer. The most complex tools such as those which machine airplane engine blocks are combinations of these simple processes.

It is not strange, therefore, in any industrial mobilization, machine tools present the first major problem. Conversion of industry is largely a retooling job.

Nothing also may serve better to illustrate the background, and the evolution of the organizations and controls, than to review the tooling period in World War II. This stage tends to grow dim against the subsequent tremendous and dramatic events. However, without this industrial accomplishment, the great campaigns could not have been fought. Military potential can be measured almost precisely by the capacity of a nation's machine tool industry.

I do not propose to discuss machine tools from the technical or manufacturing standpoint. This will be done more adequately by representatives of the industry later. My contribution will be to discuss what Government did relative to the machine tool problem. Suffice to say, relative to the machine tool industry, that no other rose to more magnificent heights. Composed of firms

frequently generations old and headed often by prerevolutionary native-stock Americans, it is a conservative industry. It has been called the aristocracy of industry. The standards of the men who compose it are reflected by the close tolerances their product demands. It has been well said that a dishonest man cannot succeed as a machine tool builder.

Geographically the industry is concentrated. A large part is located in the Connecticut valley and Ohio with fewer plants in the close adjacent states. There is one machine tool builder on the West Coast; none in the South. The employment in the machine tool industry went from 37 thousand to a peak of 123 thousand in 1942.

A dominant characteristic of the industrial mobilization of all the great powers in both World War I and II was the intense efforts to acquire large stocks of machine tools. Hitler began to retool Germany for war immediately following accession to supreme power in 1933. Purchases by Russia and Japan in the 1930's kept our own machine tool industry going. Of the 200 millic dollars worth that the industry produced in 1939 nearly 60 percent went abroad, most of it to fill belated British and French orders.

In 1940 there were in the United States in excess of 900 thousand machine tools. We possessed a machine tool industry unequalled both in capacity and quality. There were some 200 long-established machine tool builders with another 200 marginal producers. For several years the industry had been working at a high level of capacity as result of large orders from all the major powers. The productive position was favorable.

Notwithstanding, when this country undertook to mobilize industry for arms production, the first major problem was the immediate demand for machine tools. Before the arms program could get into full production, adequate to fill the requirements of the armed forces, over one million new machine tools had to be built. The machine tool industry had to telescope into approximately eighteen months what would have been normally fifteen years output.

It had been long recognized by the procurement planning agencies of the War and Navy Departments that machine tools would be an immediate and urgent problem in any major war. A planned control of the machine tool industry was foreseen as imperative. In the minutes of the Army and Navy Munitions Board Commodity Committee #30, Machine Tools, 27 February 1936, will be found the following:

"After M Day, it is contemplated that the Army and Navy Munitions Board will be expanded and that its committee on machine tools would assume active control over the machine tool situation until such time as a similar committee was organized under the War Industries Board."

Possibly in no other field of joint planning before the war was more accomplished. Studies were made of machine tool plant capacities, estimates of service requirements and some progress made in eliminating unnecessary sizes. In collaboration with the National Machine Tool Builders Association, a machine tool catalogue was developed which served not only to standardize nomenclature but provided a means of stating requirements. Finally an allocation was set up of machine tool builders plants between the War and Navy Departments.

The Navy Department developed a system in the prewar years whereby the essential specifications were determined for every tool that it was foreseen the Navy Yards would require in war time. The availability of this information when the emergency was declared permitted the Navy to place machine tool orders for its Shore Establishment with a minimum of delay. Army arsenals were retooled early in the emergency period. Consequently, the government facilities occasioned relatively little trouble in respect to tools. Their requirements, however, were a drop in the bucket compared to the demands of private contractors when conversion began in earnest after Pearl Harbor.

Despite these accomplishments, the peacetime planning to meet machine tool requirements was far from adequate. It may have been influenced by the then prevailing national policy and military plans which certainly did not conceive of the United States becoming involved in a war of the magnitude of the one just over. A fundamental mistake was that of allocating machine tool builders plants to the Army and Navy respectively as if such arbitrary division of capacity would last one day in the face of military urgency to get first things where they first could be provided. The planning neglected to provide for the immediate expansion of the machine tool industry by assurance of large orders, and credits for increase of facilities. Eventually these things were accomplished, but not until a great deal of time was lost.

Possibly the deficiencies of the machine tool planning did not matter in view of the fact that Industrial Mobilization Plan was thrown out of the window anyhow, and in lieu thereof a series of improvisations tried and discarded until after a long time we arrived back at a war organization substantially that envisaged by the Industrial Mobilization Plan.

Machine tools going to export attracted early attention. In April 1940, the Navy Department through the port authorities placed an embargo on machine tool exports to Russia and Japan, on grounds of prior naval need. In July, the Administration of Export Control was set up and the export of all critical commodities subjected to

license. Machine tools export licenses were cleared through the Machine Tool Committee of the Army and Navy Munitions Board. Eventually the Machine Tool Committee undertook the recovery and distribution to defense contractors of all tools withheld from export. In a few cases this involved commandeering.

In May 1940, the National Association of Machine Tool Builders organized a Committee on Cooperation with Government Departments. June 1, an executive order established the Advisory Commission to the Council of National Defense, of which Mr. Knudsen was designated a member. During this period, Secretary of the Treasury Morgenthau temporarily entered the field of machine tools. The services presented to him an estimate of machine tool requirements for defense products for 1941 totaling 202.5 million dollars. Actually tools to a value close to 850 million dollars were produced in 1941. Next, a Machine Tool Coordinating Committee was formed with Mr. Knudsen as Chairman. The Committee functioned as part of the Advisory Commission. It met with representatives of the War and Navy Department to consider such matters as conflicts in the Army and Navy defense program as a whole, machine tool exports, and defense requirements in a general way. Subsequently, this Machine Tool Coordinating Committee became the Machine Tool and Heavy Ordnance Division, with Mr. Vance, present head of Studebaker, as director.

The activities of the civilian agencies concerned with machine tools were largely exploratory and consultative. Conferences were held frequently with machine tool builders with nothing more definite than to inform them of general requirements and to exhort them to increase production.

At this time, the latter part of 1940, demands for machine tools in the U. S. defense program had not yet become critical. Compared with subsequent levels, the rearmament program was moderate. Contracts were yet to be placed. The machine tool builder continued in building machine tools not only for civilian production but for export. Export control restricted from export a percentage of tools, but only after the War and Navy Departments were able to establish a definite need by a definite contractor or Government Arsenal or Navy Yard for a particular tool. Tools for which such need could not be categorically established, continued to flow even to countries potentially hostile. As time progressed, on a basis of national policy more than U. S. defense needs, exports of machine tools to potential enemies were gradually cut off while all restrictions to the anti-totalitarian powers were eliminated, culminating in a general license to the British Empire. In light of the subsequent demand for machine tools, the early liberal policy on exports might be questioned. However, it must be remembered the U. S. defense industry was not yet able to absorb the full capacity of the machine tool industry. Foreign shipments helped to maintain capacity of the machine tool industry.

During this period there was no organized control of the machine tool industry or distribution of tools. Functions of the various government agencies that concerned themselves with machine tools were not clarified. The flow of machine tools into defense channels was uncoordinated and unsystematized. Various authorities both in the War and Navy Departments, and in civilian agencies would issue directives to machine tool builders, directives uncoordinated and sometimes in conflict with orders and information imparted by other authorities. Defense contractors came to Washington, consulting all and sundry as to their machine tool needs. They made personal appeals to the Priority Committee, Army and Navy Munitions Board, and various officials of the civilian defense agencies. These authorities conferred or wrote to machine tool builders supporting the claims of this or that defense contractor without regard to the importance in the general plan of defense. Individual contractors brought to bear pressure on machine tool concerns through previous business relationships. Branch and bureau chiefs in the two departments did not hesitate to by-pass routine channels to get the tools for their own programs.

Before the emergency arose, the Air Corps and the Bureau of Aeronautics had agreed that all aircraft contractors' tool needs should be consolidated under the Air Corps. The Air Corps and the Office of Production Management established an aircraft scheduling unit at Wright Field to handle contractor's material problems. A machine tool group was included in the organization. The Navy Bureau of Aeronautics was represented by an officer. The channel for presenting machine tool requirements was direct between Wright Field to the Aircraft Production Unit, Office of Production Management, who in turn presented tool problems direct to the Tools Section of the Office of Production Management. Either by accident, or through lack of knowledge by those who set up this separate organization, the Army and Navy Munitions Board was by-passed. The Board could not exercise its coordinating function, or contribute to the solution of the aircraft industry's machine tool problems. This duplicative method of handling tool demands led inevitably to confusion in the overall control of tool production, and was not conducive even to the best interest of aircraft production. Happily this situation was eventually corrected. The Aircraft Scheduling Unit channeled its tool requirements for presentation to the Office of Production Management through the Army and Navy Munitions Board.

Among the first definite steps taken by the Army and Navy to meet machine tool demands were the facility and supply contracts

with a substantial number of tool builders late in 1940 and early in 1941, without, it is interesting to note, appropriations for the purpose. By means of the facility contracts the government financed machine tool builders plant expansion. The supply contracts covered purchase orders for machine tools in advance of assignment to definite war contractors. The object was to assure an adequate supply when the defense contractors were ready to place orders for tools.

These blanket or pool orders as initially placed by the branches and bureaus were uncoordinated and loosely administrated. In a sense it was preclusive buying by the branches and bureaus. Each put a fence around their own pool orders. This was true of the Bureau of Ships orders; it was true of the Air Corps in the so-called "1,000 Bomber Program." It was a mechanism by which it was possible to escape all controls such as priorities.

The Defense Plant Corporation, a subsidiary of Reconstruction Finance Corporation, had been organized in August 1940. Its function was to finance facility and supply contracts, using funds appropriated to it by its parent organization. In February 1941, it made available 35 million dollars for the purchase of machine tools. This was shortly followed by 200 million dollars more for tools for the "Thousand Bomber Program." In addition, the Defense Plant Corporation expended about 16 million dollars before Pearl Harbor in the expansion of machine tool builders' facilities. In these transactions, the Defense Plant Corporation was underwritten against financial loss by take-out letters from the War and Navy Departments signed by their respective Under Secretaries.

Eventually, the pool orders were brought under rigid control. They could be originated only by the War Production Board. They were submitted to the Army and Navy Munitions Board for comment and then to the Secretary of War for approval before transmittal to the Defense Plant Corporations for placing of the purchase contract.

The Army and Navy Munitions Board maintained statistics and policed the pool orders. If any particular type were not moving; i.e.; firm purchase orders from contractors were not coming in to take up the pool tools, then the War Production Board was promptly advised and the pool order for that particular type, reduced or cancelled. By this means, the Government was kept from being "stuck" with a large number of tools for which there developed no actual demand. Altogether pool orders for machine tools reached \$1,945,454. When they were finally stopped with ending of critical demands for machine tools, cancellation costs were less than 10 million dollars. The forward estimate was wrong less than one-half of one percent.

The pool order contract permitted a cash advance for working capital to the tool builder of 30 percent of the value of the order. Pool orders were placed with 265 tool builders. The amount of cash advanced totalled \$392,163,305. All these purchase orders were subject to cancellation. Under the terms of the form of contract, the Defense Plant Corporation agreed, upon cancellation, to reimburse the builder for all proper expenditures.

Pool orders were also placed with gage and cutting tools manufacturers on a somewhat different basis than those for machine tools, but with the same purpose of stimulating their production ahead of the placing of purchase orders by war contractors.

In any future emergency, among the first steps, should be the placing of large pool orders throughout the machine tool industry, and the government financing of machine tool plant expansions. Indeed the procurement plans, should include ready pool orders detailed to types and sizes, ready for placing in the machine tool industry. Such pool lists should undergo frequent revision based upon obsolescence of tools in the reserve, and the strategic plans of the armed forces.

These large pool orders placed immediately may also serve to relieve the services of a demand with which they were constantly bedeviled in the early stages of the war. The WPB wanted to know "what are your requirements." The machine tool industry made great play of "Tell us what you want and we will build them." Of course this is nonsense. Until the strategy of a war crystallizes and the consequent arms programs can be set up, the only thing that can be told about machine tools is that a lot will be required. Pool orders are the answer.

The War and Navy Departments had placed a substantial number of machine tools in storage after World War I. These were, of course, a great help in getting production lines started. A similar program for reserve tools is now in progress.

Much effort was devoted to surveys of existing tools, with a view, of course, to transferring them from non-essential industries to those having war contracts. It is doubted whether the results justified the effort. The smaller industrial firms of the U. S. had been suffering from a decade of depression. Naturally, they were hoping for war contracts and were unwilling to surrender any of their equipment. Again, about the only domestic purchasers of machine tools during the depression were the large corporations. As these were the first to secure war contracts, all the relatively new tools were already being used in war work before the tool surveys of 1941 got started.

As an example of the doubtful value of such surveys, the one conducted in 1941 by the Artillery Division of the Ordnance Department is cited. All builders of certain types of scarce tools furnished the Artillery Division with a list of every such tool shipped during the five year period from 1935 to 1939 inclusive. For each tool so reported, a card was made and sent to the appropriate Ordnance District Office for investigation and reporting to Washington of complete data as to specifications and current work load. Many officers made uncounted trips of investigations. A large clerical staff in Washington compiled and filed the reports. The few idle and available tools found, I doubt, justified the effort.

From time to time, there were outcries in the press or from other uninformed sources, of great quantities of idle machine tools in one place or another. Invariably when investigated, such tools were either not found or were unsuitable for arms production, Sears Roebuck lathes, "dime-a-dozen" drill presses, etc. Tools in railroad repair shop were pointed to without regard for the fact that their coarse working tolerances were generally unsuited for arms production. Tools in technical and training schools were brought up, without consideration that such tools were vitally needed in training programs. The tumult about idle or surplus tools was largely baying at the moon and about to as much purpose.

The basic problem in machine tools was always one of distribution. To control distribution of plant equipment among the various claimants production scheduling was resorted to by the War Production Board. To limited degree, a form of production scheduling was applied to machine tools. Under this control method, manufacturers sent their forward production schedules to the appropriate products branch of WPB, where delivery dates were reviewed and adjusted to relative urgencies of the various arms program. Then they were returned to the tool builder for modification of deliveries.

While great pretense was always made of the accomplishments of production scheduling, I feel that its usefulness was strictly limited for items produced in limited numbers, and by only a few manufacturers large overhead cranes, heat treating furnaces, and the like -- central agencies in Washington could review deliveries and change them to better fit the relative urgencies. But for products running into many thousands a month and produced by many manufacturers, it was literally a physical impossibility for any group in Washington to make a review of such production schedules. After the monumental clerical job by the manufacturer to reproduce the schedule, the result was often simply rubber stamped in Washington. Production scheduling was never extensively applied to machine tools. Some good was accomplished

in the cases of a few very critical type tools. Field groups from WPB went to the builders and brought delivery dates in line with realities. Some arms manufacturers occupying top priority positions would order a hundred tools for delivery dates before they were ready to use ten or sometimes before the walls were up in the plant. In a future occasion, production scheduling for machine tools could be employed to this limited extent -- field groups to check unrealistic delivery dates.

Control of machine tool distribution by priorities was not effective. In May 1940, priority for deliveries of machine tools was reviewed in a series of conferences between the Army and Navy Munitions Board and the Advisory Commission. Shortly thereafter, Congress by Public 671 of 28 June 1940, gave the President discretionary authority to require priority for Army and Navy contracts. An Army and Navy Munitions Board memorandum of 12 July 1940, to Mr. Donald Nelson stated that "voluntary" priorities on Army and Navy contracts should be relied upon as long as possible before invoking mandatory priorities.

Priority control over deliveries of machine tools was first exercised by the Priorities Committee, Army and Navy Munitions Board. For tools required by machine tool builders themselves priorities were administered by the Priorities Division of the Office of Production Management. In matters of priorities of delivery to foreign countries, the Tools Division of OPM made the arrangements with the foreign representatives after the general policy has been decided in the Division of Defense Aid Reports.

The correlation of military objectives and production with preference ratings were covered by a series of Army and Navy Munitions Board directives. By November 1940, however, so many projects had been placed in the highest bracket that a breakdown into sub-classifications became imperative. Constantly, demands were made for assignment of AA ratings originally reserved for extraordinarily urgent situations.

Not only the bureaus and branches, the Priorities Committee of the Army and Navy Munitions Board, the Tools Division, Office of Production Management, but high authorities in Washington were bombarded by requests from this and that defense contractor, to put pressure on machine tool builders for expedited deliveries. Not only the defense contractors made such direct appeals, but high officials, government and emergency, as well as branch and bureau chiefs, exerted the prestige of their office to demand that the Tools Division, Office of Production Management, further this or that

tooling program. Sometimes these mandates were in direct conflict. The Tools Division, OPM, handled each critical tool demand as it came up, and on a basis of day-to-day expediency, frequently, I am afraid, not by the urgency of the project, but on the basis of the noise and rank of the advocate.

The overloading of the upper priorities and the many and occasionally contradictory directives issued to the machine-tool industry by various Governmental authorities finally resulted in such confusion that most machine-tool builders gave up and scheduled defense deliveries on the basis of date of receipt of the order.

As a first step in improving this situation, general agreement was reached that all defense contractors must refer their tool demands to the contracting bureau or branch and not go directly to any other authority. On the other hand, all contracts with the machine-tool industry could only be made by the War Production Board. The services referred valid contractors' machine-tool troubles to the ANMB, who followed up the matter with the WPB. These were notable steps in regularizing machine-tool procedures. It relieved the machine-tool builder of the bewildering effect of receiving instruction from various officers in Washington.

Next, Mr. Knudsen requested a joint priority list from the War and Navy Departments showing a consolidation of the most urgent defense contractors arranged in a single numerical order. Realizing that such a list would have little value unless accompanied by rules covering its employment, the Army and Navy Munitions Board was successful in appending a control plan to the Master Preference List. It was issued by the Office of Production Management on 7 July 1941.

This distribution plan was based on the policy of "first things first." Accordingly, arms contractors were assigned priority positions by grouping them under "preference ratings, A-1-a, A-1-b, A-1-c," etc. The contractors in each preference rating group were assigned a numerical "urgency standing." Printed lists were furnished machine-tool builders. The priority standing of a contractor who did not appear on the list was determined from his preference rating and the date of his order as shown on his preference rating certificate, which every purchaser of a machine-tool was required to have before his order could be accepted by a machine-tool builder.

This plan had two serious faults. It promoted extravagant ordering of tools and gave all deliveries of scarce tools to the highest urgency standings of the A-1-a preference rating group with the result that a few contractors had excessive quantities of machine tools, many of which stood idle for long periods before they could be put to use, while other contractors were unable to get enough tools to complete their pilot lines.

There was constant jockeying for top priority A-1-a. Branches and bureaus whose programs did not have the highest priority position were constantly appealing for this position. They made appeals to the highest quarters, with the result that mandates were being received from sources that could not be disregarded. "Put this program in A-1-a." The high rating became so inflated that it had no significance. I inspected machine-tool builders' schedules where practically every purchase order had an A-1-a rating.

The prize-fight promoters employ the same technique. I remember going to the Louis-Conn fight. I had a couple tickets marked "ringside." When I got to the polo grounds, I discovered I was just close enough to tell it wasn't a baseball game.

It would not have been so bad if arms contractors would have placed honest delivery dates on their machine-tool orders instead of wanting everything "yesterday," with the result that tools often arrive before the plant roof was on. Officers designated to authenticate preference rating certificates enjoined to demand realistic delivery dates on purchase orders, but usually, through ignorance or otherwise, they exercised little restraining influence.

Finally, to solve the problem of controlling deliveries of machine tools and to give each claiming agency a proportion of machine tools justified by the size of its total arms programs, the Army and Navy Munitions Board originated an entirely new controlling device. It was known as General Preference Order E-1-b. It was accepted by the WPB and was issued in May 1942.

First, a basic division was made of 75 percent of all monthly deliveries of tools to the contractors of the armed services and 25 percent to all others; i.e., other domestic and foreign purchasers. The demands of this latter group were taken out of the hair of the War and Navy Departments and left to the WPB to distribute.

The services' 75 percent of monthly deliveries of tools was divided among the branches, bureaus and Maritime Commission. This allocation was based on the proportion of actual purchase orders on the books of machine-tool builders for all the contractors of each branch or bureau. For example, if at any one time the entire machine-tool industry showed 1,000 orders for 14-inch engine lathes and, of these orders, 100 were from purchasers working on Ordnance Department contracts, then the quota for that branch was 10 percent. That meant 10 percent of the monthly output of each builder making 14-inch engine lathes. In other words, Ordnance could not take its entire quota from a selected firm. It had to spread its orders across the board. It could not corner the "Tiffany" tools.

Inside its quota, a branch or bureau could make any distribution. Each set up a list showing order of preference for its contractors. The ANMB periodically revised the priority lists and supplied them to all machine-tool builders for reference in scheduling deliveries. With the simple rules and explanation, this system of control provided the machine-tool builder with a formula for scheduling exactly every tool he built for the arms program without reference to any master-minding in Washington.

The system was realistic; it was tied to a true indicator of demand; i.e., purchase orders on the books. An immediate effect was to introduce economy in ordering of tools and to permit deliveries to contractors who, under a straight priority system, would have had to wait indefinitely for deliveries. In short, it brought the entire tooling program in line to serve a balanced arms program.

The system embodied the fundamental principle that, when a large number of situations are to be continuously dealt with, a majority will eventually be found whose handling can be reduced to formula and routine. Possibly, only 10 percent has special descriptions which have to be specially handled by central authority on individual merits and with all rules by-passed. In machine tools, this was expressly provided for. Any arms contractors having difficulties getting deliveries of tools under the over-all control could always appeal to their contract branches or bureaus, which, in turn, went to the Army and Navy Munition Board. If special measures were justified, the ANMB would take action with the WPB to expedite delivery of tools.

One obstacle to the completely smooth functioning of control of distribution of machine tools were the efforts of special interests to by-pass the rules and get tool deliveries for their programs, regardless of the impact on other programs. The rubber program, the high-octane-gas program, and the Manhattan Project always enjoyed overriding priority for tools. From a practical standpoint, this was not too disturbing in light of the relatively small number of tools required. On the other hand, the number-one priority assigned Carrier in 1942, the Landing Craft Program before the North African Invasion, the destroyers' escorts until 1943, trucks in 1943, the torpedo program and the aircraft program in 1943, and combat-loaded transports in 1944 and 1945 had a disruptive effect on tooling for a balanced arms program. These programs were all profoundly important, but wars are not fought by having a complete supply of one type of armament with shortages of other types. These "green lights" or "blank checks" were often obtained by branch or bureau heads going to exalted political personages and getting a "ukase" that their program should have overriding priority. The "green light" for the tremendous aircraft program was one example. The result was usually a wasteful ordering of tools, while other programs starved. The needs of programs, no matter how urgent, can be served by orderly procedures.

From 1 January 1940 through July 1945, the Machine Tool Industry built 4.2 billions dollars worth of machine tools, or something over a million units of which about a quarter was exported. This is normally the output of about 15 years. Before the war, an average year for the machine tool industry was about 250 million dollars. In the depression in 1932, the output was 22 million dollars. The war-built tools are bound to have an adverse effect on the machine tool market. After the postwar production years, particularly during any period of depression, the machine tool industry may be at a low ebb. Any nation emergency occurring during such a period, say 5 of 15 years hence--would find us in a precarious position for tooling for new arms production. The machine tool industry may not again have the benefit of several years of large foreign orders and build up such as the emergency period before Pearl Harbor. Providence may not always be so indulgent.

You have seen that it took 12 months after Pearl Harbor to bring machine tool production up to maximum output; arms production, 23 months. This time could have been substantially reduced, had the measures and controls, which so slowly evolved, been ready and adopted at the outset of the emergency.

My conception of the Industrial Mobilization Plan is that it will outline the general principles of industrial mobilization, specify the war agencies, their broad organization, and their functions and authority. The war functions of the permanent civilian agencies of the government may be indicated.

The specific controls and procedures for the various divisions of the war economy--raw materials, manpower, plant equipment, etc.,--should be set forth in annexes. The annex for machine tools and other plant equipment should provide upon approach of an emergency for:

- (a) Pool orders for 100 thousand machine tools with proportional amount of gauges, cutting tools and other plant equipment. 30 percent cash advance with orders should be authorized.
- (b) Invocation of priority for all defense connected tool orders to be followed as soon as tools approach short supply by an allocation system similar to General Preference Order E-1-b.
- (c) Government financing of machine tool plant expansions.
- (d) Deferment of all machine tool workers from the draft for one year.
- (e) Maximum employment and training of women workers and armed forces ineligible.

(f) Reference of arms contractors tool troubles to the contracting branch or bureau and nowhere else. The latter to refer valid claims to the ANMB for corrective action and not to the Machine Tool Industry direct. The industry to deal with the ANMB and no other agency of the government, until the War Production Board is organized.

(g) Export licensing and clearance by the ANMB of all machine tools and other plant equipment.

One final word perhaps unnecessary to a group such as this. Industrial Mobilization can pull no rabbits out of the hat. Under the best of conditions industry cannot be converted to arms production short of six months. The initial onslaught must be met by weapons on hand.