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THE ARMY INDUSTRIAL COLLEGE
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THE MACHINE TOOL INDUSTRY

by

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National Machine Tool Builders' Association

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Mr. Chairman and Gentlemen:

I learned something during the Colonel's introduction. We have a very efficient lady in our office who asked me some discreet questions this week - I now see some of the answers.

Concerning this horse and buggy business, I would like to tell a story that I never before have told in public to a group of people. It is an absolutely true story, and as reference was made to the horse and buggy days I was reminded of it.

When just a youngster I happened to be a clerk in the trimming shop of the old Columbus Buggy Company. In the department was a roustabout - Jimmie Fitzpatrick. Jimmie was a very husky individual, weighed about 190 pounds, and was all muscle. He was reared in a convent, hopped the fence at the age of ten and started out on his own. Jimmie married a very small German girl. As you know, at that time men drew very little money and Jimmie was held pretty tight. At first he was paid 15¢ an hour. I put up a battle to get 17½¢ for him and finally got it. One day he asked that when he had overtime coming that it be issued in a separate envelope. I said, "Sure, Jimmie, but why?"

"I don't want very much money to spend, but the old lady takes everything from me and I would like to have fun once in a while."

I fixed it. The next morning when Jimmie came I asked him how he got along. He said, "What do you mean 'got along?'"

"With that spare envelope?"

He said, "What do you think happened? I gave her the wrong envelope first!"

I have seen a good many outlines of analyses of industries, but I have never seen one as good as the one that was sent to me as an indication of what you wish to hear about our industry. In fact, it is so good that I am going to work entirely from it in straight line order.

The first question that appears is the Delineation of the Industry Machine Tools are - well, we like to call them - "the master tools of industry " Our industry is the farthest back of all the machine industries. Machine tools are capable not only of making all other machines but of reproducing themselves We use the definition that a machine tool is a "power-driven, complete metal working machine, not portable by hand, having one or more tool and work holding devices, used for progressively removing metal in the form of chips " That leaves out presses and brakes and metal shears and metal forming machines in general, but it does include grinding machines because grinding machines remove metal in the form of microscopic chips.

The importance of the industry is out of all proportion to the volume of its annual business As you will see a little later from the charts, the volume runs to about 100 to 125 millions a year in normal years That sounds very small as compared to a great many other industries, but the economic importance is more in relation to the length of time those tools are in effective use in the production and flow of goods Economists generally will admit that the Machine Tool Industry's relative importance is equivalent to about ten to fifteen times the normal size of its sales because machine tools remain in effective use about that length of time.

There are in the country about 250 companies making machine tools The distinctively machine tool building companies number probably 150 or 160, the others are in the main companies, engineering concerns, foundries, and machine shops that make tools as a side line They may make a little drill press, or a small lathe, they are machine tool builders, of course, but machine tool building is not their prime business For all practical purposes you can consider that there are about 150 to 160 machine tool plants devoted to that work. The average size is small, involving an investment of some $500,000 to $700,000 Of course, that takes in some companies that are very large, where the investment amounts to eight or ten millions, and some very small companies of around a hundred thousand.

The average company employs from 200 to 250 men. Again, some of the plants employ several thousands Most of

the companies are owner managed, that is, owned by one man or by a small group of men. In many cases the business has been handed down from generation to generation We have a number of plants in which the third and fourth generations are the manufacturers today

There is invested in the business about $125,000,000 and normally it turns out a little less business per year than the investment - around a hundred million dollars In especially good years the sales exceed this up to about one hundred and seventy-five million. The value added by manufacture is approximately two-thirds That is divided roughly into about one-third for materials, one-third for labor, and one-third for engineering development, overhead, taxes, etc. The highest employment of which we have a record in the industry, was in 1919 about 53,000 men The probable average now is around 40,000

Distribution of plants Chart I.(1) Practically all machine tool manufacture is confined within the northeast section of the country. The business started in New England something over a century ago and as the need for machine tools spread to the West the industry branched out A group of manufacturers started in Cincinnati before the Civil War, and that is now one of the principal centers. We consider, for our purpose in describing the location of machine tool builders, the New England territory as a whole Plants are scattered throughout New England in Massachusetts, Rhode Island, Connecticut and Vermont. Then we come west to two great centers in Cincinnati and Cleveland, and in the last half century a great number have come into existence around Rockford, Illinois. We consider Milwaukee and Chicago as a part of the Rockford District There are one or two smaller manufacturers on the West Coast, but generally speaking the whole line of manufacture is in the great northeast industrial area

The importance of being near raw materials is not nearly so important as it is in many industries because the tonnage of materials used for the manufacture of machine tools is not great tonnage in proportion to the value of the finished product It is far more important to locate a machine tool plant near the users, that is, from the standpoint of sales and service. While there are a great many plants located in small communities, there is

(1) Chart I not included

a greater tendency to concentrate in cities, as in Cincinnati and Cleveland, Ohio, Worcester, Massachusetts, Hartford, Connecticut, and Rockford, Illinois There is no very great difference in cost between the small communities and the large. There is a little difference in the wage rate per hour, but this is offset by the necessity to carry larger stocks of materials of various kinds, so that in the long run it amounts to about the same thing

The tariff has been some factor in growth but not to a great extent Formerly there was a thirty-five per cent tariff on imports of machine tools, this was dropped to twenty-five per cent for a few years and was then brought back to thirty per cent The tariff has afforded some protection, but the growth of the American machine tool industry as compared to that of other countries is more largely due, I believe, to the greater expanse of country, the greater necessity for mechanization, and the wealth of our raw materials The perfection of the mass production of goods has been responsible for the development of the Machine Tool Industry in the United States far ahead of foreign countries The foreign countries are making quite an effort to cut down that differential now and they are making quite a job of it In some cases they duplicate our equipment to the extent that if one should not happen to see the name plate he might think it one of our own

Relations with Federal, State and Municipal Governments I do not know just what is expected under this heading, but when we come to the end of the talk if I have not made this topic sufficiently clear I would appreciate any questions that you might have. I might say that the Machine Tool Industry's relation with the Army and Navy, at least from the machine tool builders' end, is most excellent. Nothing more could be desired To the last man all have the highest respect for the Army and Navy and will go a long way to do anything they can to preserve the mutual friendliness that exists The Federal Government is quite a large purchaser from time to time, but not as large as we had hoped it would be from the standpoint of seeing that the Government plants are in most excellent condition, quite as much as from the standpoint of our own business.

Variety of Production There are no byproducts in this industry but there is a large variety of production As you know, there are five arts of machining metal milling, turning, boring or drilling, planing or shaping, and grinding. These rough classifications, however, do not tell the entire story as there are many subdivisions of each classification, machines developed to do this or that While they all come under some one of the general categories, the sub-classes extend down pretty far. We have gotten out a little book, giving the types of machines manufactured by all the people in our organization, and I have arranged to leave a copy for the record More are available for those who can use them.

The next question has to do with bulk in our industry. As you know, we have machine tools that range all the way from the size that could be set up on this reading table to those that would require a space as large as this room There is nothing perishable about a machine tool except that it grows obsolete and eventually wears out. "Wear out" is scarcely the proper term, it would be better to say that machine tools gradually lose their accuracy under hard usage But the greatest factor is obsolescence.

You are no doubt familiar with the study made by the "American Machinist," showing that 65 per cent of the machine tools in use in this country in 1935 were more than ten years old. The age percentage in your Washington Navy Yard is higher than that. According to the figures, as I remember them, the total investment of mechanical equipment in the Washington Yard, including machine tools, about three years ago was given as around fifteen million dollars At four per cent depreciation per year this equipment had by that time depreciated in value nearly to two and a half million dollars, so you see the Washington Navy Yard would stand very far down the line in degree of modernization

Patents and Brand Names Trade names are tremendously important in our industry. Patents are less so, although there are a great many patents. Trade names such as Brown and Sharpe, Pratt & Whitney, Gleason, Cincinnati Milling, and many others, all mean something to any of you who have ever had anything to do with things mechanical. I mention only these four or five, but there are a hundred or more, not so old but

thoroughly well known I know of no other line of business in which the manufacturer takes so much pride in his firm or is so anxious that every piece he sends out under his trade name be up to the standard that he is building to. There are, of course, a number of manufacturers of each type of machine tool, not all of whom intend or pretend to turn out the highest quality or the best because there are places for many different grades and qualities, but for the industry as a whole every concern is most particular that its customers may be assured of getting the quality in each machine that their trade name represents.

Research, Development, and Improvement That is another interesting point about this industry As we will see on a chart a little later, the greatest impulse to research and development is given by the extreme irregularity of the business During the periods when business is good our plants are very busy and production and engineering are rushed. You see, we do not have only the engineering necessary to develop new line or new type of machine tool, we have also considerable engineering in connection with equipping machines for special lines of work. That part of engineering goes on constantly So, when things are going strong the engineering departments are very, very busy It takes the same type of engineer, generally speaking, to design equipment for a special job to be turned off the machine as it does to develop a new machine. The result of that is that when the shops are busy the engineers see the greatest need for new types of tools and new developments, but they are too busy to go ahead at that time They store their ideas, put them to the back of the stove, so to speak, and then when business dies down they bring them out and keep their key men engaged in working out the problems Consequently, development work is carried on mainly in the dull periods That happened to such an extent in the last depression that many lines were completely rebuilt, with higher production, tremendously greater accuracy, greater ease of handling, and in addition a better use of electrical equipment, greater adaptability for the use of new higher speed alloy cutting steels While the people thought that the Machine Tool Industry of America was pretty well developed before, the last five years show a remarkable stride forward.

Some of you attended the Machine Tool Show in Cleveland last fall, but for those who did not I will tell you a little happening A representative of one of the biggest automobile concerns, who probably has bought more machine tools than any three or four other men combined, and he is still buying them, came early - the first day - and then sent for about fifty of his men foremen, superintendents, etc , to come When he left on the third day he looked me up to tell me that he had expected some development, but that he had no conception of what had happened in the last five years. There was a man who knew! For you men who are interested in the Government plants, I think it is safe to say that it is quite essential that you become pretty thoroughly familiar with what has happened during this time.

Style Influences. There are trends rather than styles in the industry. For instance, a few years ago many machine tool users wanted to have a machine tool that would take a piece in and turn it around step by step and bring out the finished product, all automatically. That went on for some little time Now some of them feel that they would rather have a lineup of various tools to do that work There is a flow of ideas in one direction, but they can scarcely be termed "styles." Some of our new machine tools though are being made better looking through design and style. That applies also to the plants - to inspire the men to appreciate a little the fact that they are working on a fifteen or twenty thousand dollar tool

Standardization and Simplification. Simplification is a double angle too. In some ways the machines are becoming more complex but that is because of the requirements of the work coming off them Nevertheless, the attempt is made at all times to simplify operation of them In other words, we have complex jobs to do on the machines and the effort is being made all the time to do it more easily and simply, and of course with less effort on the part of the men. There is some little distance to go in that with regard to some of the tools. Occasionally we find that we put too much on a single tool. We try to incorporate every mechanical movement in a single tool that can be thought of and then we find that possibly those refinements are useful in only fifteen or twerty per cent of the cases Somebody will then come along and take off what he feels not essential for the operation in most cases and puts on the market a much simplified machine

Standardization is limited largely to machine tool elements. There is a limit to what an industry such as ours can do along that line. It would be a mistake for us to go into standardization to the point that we discourage development On the other hand, spindle noses and other things are used to make tools interchangeable So far as possible we work in that direction.

Raw and Contributory Materials The body of the machine is in most cases cast iron. The quality of that cast iron is being built up all the time - that is, getting a higher tensile strength and stronger material There is no difficulty in getting the raw material for the machine. It is all available in this country When we get over into the alloy tool steels a different problem is involved I do not think that I need to go into that. I believe Mr. Brooks Emeny put out a record of materials that would be much more valuable than anything I might be able to tell you. We are looking toward carbide tungsten tools in such cases as they can be used I think that is a subject that is worthy of a very special study from the standpoint of the War and Navy Departments

Seasonal Factors. There are no seasonal factors in particular. The question is simply one of demand and when the demand is there we can usually get the materials. There are less stocks carried now than formerly, at least in the finished state. Probably that is due to the fact that more and more orders are for special work. I saw a lathe the other day in which the tooling equipment amounted to fifty per cent more than the lathe itself The question of stocking is largely a matter of stocking the units which put together in different ways go to make a somewhat different machine

Transportation There are no particular worries about transportation, but there is something in connection with transportation that I will touch on a little later

Price Stability. The tariff has no great influence on prices. It is high enough for the present to keep our plants in good competitive condition, and we are able to sell a great deal of goods in foreign countries irrespective of the tariffs they put on.

Monopoly Control. There is no monopoly in the industry. If there is one individualized industry in this country it is the Machine Tool Industry, and it is very natural that this should be so. A man has to be satisfied with something other than monetary returns to be in the machine tool business, generally speaking. The original builders of machine tools a century ago were engineers who I feel have had a tremendous influence on the direction of American industry. The joy of achievement compensated instead of money in a great many cases, and that still is the case.

The industry has fed a tremendous number of men into other industries. If you were to go through the great automobile plants and refrigerator plants and all the newly developed mechanized plants you would find a surprising number of executives, engineers and mechanics who got their start in the machine tool business The industry requires a bent for development and pioneering that appeals to certain types of engineers, and usually such men are not particularly interested in building great monopolies

Competitive aspects Competition is quite as much on quality and ingenuity of adaptation as it is on price.

Production Processes The big step here is in introduction, of course. The bulky thing is the making of castings and then the machining of them We cannot in our plants mechanize to the degree that our customers can. The reason for this is that an order of fifty machines of a type is a tremendous order in our industry, so there is not the opportunity for any mass production methods. There are a few parts that may be made in quantity, such as gears, for instance, but not nearly to the extent they are made in our customers' plants. However, our industry is modernly equipped, irrespective of the fact that we lost a tremendous amount of money during the depression Within the last two years a great many of our plants have installed new machinery. As they are able to make a little money a great many more of them will modernize their equipment.

Predominating Machine Types A machine tool plant uses every type of machine. In some cases planers are largely used, in other cases, lathes, but every kind is needed to produce their own machines.

Adaptability to Change. The ingenuity of the men in the plants and their background of engineering and the experience they get from doing things in their customers' plants would enable the plants in the machine tool industry to change over to some other type of product, if that were desired, rather readily. For instance, hydraulic presses are not in our line of business, but we have plenty of plants that could readily adjust to production of hydraulic presses if it were necessary. I presume that is what is meant by the question Of course, they would not be able to adjust themselves readily to mass production because they do not have that kind of plant layout, nor that kind of building, generally speaking, and of course do not have that kind of equipment.

Power Requirements These are not so large I mean the industry as a whole does not take a great deal of power although individual machines do require considerable power.

Patent and License Control. On some few items there is inter-change of licenses and patents but that is not general. So far as the Army and Navy are concerned I think I can safely say for the industry that in the event the Army and Navy should want machine tools of a certain type quickly, I do not think there would be the slightest difficulty in working out a fair proposition in almost any direction.

Seasonal and Cyclical Characteristics. These are best shown on the chart (Chart II). Orders for machine tools fluctuate over the years of any industry we know. Notice the peak in 1919, when the Index rose to 210, due, you will recall, to our heavy foreign trade and active domestic business. Some of you helped to bring it up. Then see where we went in March, 1933 - down to 8. This curve is smoothed by using a three months moving average. The month to month figures would show even more irregularity If we were to plot the ups and downs of individual companies their curves would be still more irregular. In other words, this chart will give you some idea of the management problems of a machine tool builder, who must employ mostly skilled men, and must provide steady employment for them At this particular time orders are on the uptrend, with little interruptions every few months. We have such an interruption now, as evidenced by the slight downturn on the three months average, but that will not worry us, as the curve will turn up again in a little while In 1933 the Army and Navy

helped our industry by placing orders for about five and one-half million dollars worth of machinery. That was much appreciated by the industry.

Labor. It is estimated that about two-thirds of the men in a machine tool plant must be skilled men, with possibly one-fourth of those highly skilled That is due to the fact that the operation of a machine tool requires some skill, and the tooling up of a machine requires still more skill. The product that comes off the machine tool can be no better than the quality that is built into the machine. There is the question of accuracy, the question of quantity, and the question of production costs. There is a great variation in the character of materials to be machined. There are not enough repetitive operations to use very many men that are skilled in only one operation. During the depression our people simply could not afford, just did not have the cash, to retain all the men they wished A machinist or a high-grade mechanic is not the type of man who, when a depression comes along, just sits doing nothing We made a study when business started to come up in which we took two typical plants in two different sections of the country and asked them to analyze their 1929-payrolls and trace out every man they possibly could. They did that, and found that during about four years between thirty and thirty-five men out of a hundred had been lost to the industry and most of them permanently Some of these mechanics had opened garages of their own and were doing quite well Others had gone into business widely different from the machine tool industry and were making good. We found them on milk wagons making more money than our people could afford to pay them, and some of them said they did not have the responsibility - deliver a bottle of milk and the job is all done but make a mistake in machining a part and the responsibility has just begun In the end the industry lost about twenty-five per cent of the men employed in 1929. Of course, there were few apprentices trained during the depression, and a great many of the men who did not come back had grown older and I want to tell you there was a lot of difficulty when we brought them back. Men who in 1930 were proficient and capable came back to work after two or more years elsewhere, almost afraid of the machines they were operating They were nervous, their eyes had changed, and they had become soft Some of our wiser manufacturers, recognizing that,

practically set up different departments for the rehabilitation of those men who had been out, putting in charge a patient foreman who got them back on their feet again. Practically all of our people who had run apprentice schools have now reopened them. Also, we found another thing, a good many college men and high school men that came out during the years of '28, '29, '30, '31, and '32 who had not been able to get satisfactory jobs liked the idea of going into shops and taking up apprentice work, and those young men seem to be going through with a great deal better speed The boy who has taken his own automobile or his father's automobile apart and put it together again has some mechanical ideas, and many of our people report that those particular young men are becoming very proficient much more rapidly than was so in the older, slower four-year indentured apprentice course, although I would not for the world have you understand that we are not strong believers in that long apprentice course, even taking these better boys through that course because they will come out still better

Some of our people have splendid apprentice courses One of our manufacturers mentioned the other day the whereabouts of some of his former apprentices. I am sorry I do not have the figures, but there were represented a few presidents of companies, more vice presidents, and a number of chief engineers and general superintendents That is the radiation of men out of the machine tool industry into other industries.

Wages - Regional Differentials Wages for skilled machinists, and I think a good many of our people will agree with me, are not as high as they ought to be relative to other wages Up until the last depression they were pretty well able to compensate for that by steadiness of employment, but the depression interfered with that. It does break the heart of our management to be able to pay only 80¢ or 90¢ or $1.00 an hour to a fine tool maker when the tool maker has to pay a bricklayer $1.50 an hour to lay a few bricks, but for the present there just does not seem to be any way out of that. They are all interested in paying all they can, and of course there are ordinarily other compensations such as steadiness of work.

There is some difference in wages, as I mentioned a few minutes ago, between small communities and large communities, but the cost of living compensates for that.

Rates of turnover of the men are very low relatively You see, with plants averaging 200 to 250 men, the management and men become very closely associated because of the nature of their work. It is necessary for management to keep track of the work and see what goes through It is not an unusual case at all to see the president of one of our companies down on his knees beside a mechanic examining some part or listening to suggestions There is that close relationship that is good in any business and serves to help keep down turnover. The close association also accounts in part for the fact that there is not much unionization.

I came into this industry in 1932, just when the depression was at its lowest, and I called on a good many plants - a hundred within six months. I talked with the presidents. There were no wheels turning, you understand - one just did not hear a thing The president would wonder how long the condition was going to last and whether or not he would be able to ride the storm through. That is what he said first but immediately following he would say "I do not know what to do about my men I have been taking care of them as well as I can," and I have actually seen tears come to the eyes of the presidents of those companies as I talked with them. Then I would go out into the plant where were perhaps two or three or four men in the entire plant and talk with those fellows. Their comments were: "It looks a little flat around here I do not know how the old man keeps going. I would not want to have his worry." There was an understanding of the problems of the other by each, which was a very fine thing.

Working and Living Conditions I often think that by and large there is no man that enjoys a more comfortable life and gets more satisfaction out of it than a highly skilled mechanic who goes home with his day's work done and can take care of the little things to be done around the house, and who goes back in the morning knowing that if there is any work in any form anywhere he can get it. Relatively speaking, the working and living conditions of the employees of this industry are very high as workmen go. The employment is not a matter of seasons, it is simply a matter of the cyclical gyrations of business

Markets and Marketing It is fitting to begin our discussion of markets with a look at the chart of orders (Chart III). The shaded area represents domestic sales, the light section, foreign sales Over the years about twenty to twenty-five per cent of the total sales are for foreign destinations.

I might touch on a few humps in foreign sales For instance, in 1935 a quantity of new equipment went to France, when one of the automobile concerns went into mass production and re-equipped their plant in about two months' time Late in 1933 Russia did the most buying. Russia has also been doing considerable buying through 1936, but the bulk of the orders in 1936 have come from England This chart gives a general picture of the relation of foreign and domestic sales over a six year period Imports of machine tools to this country are relatively unimportant.

The customers of the industry are all the metal working shops, including a miscellaneous category of industries, as you well know. Our marketing is carried on in two principal ways There are what we call "dealer sellers" and "Direct sellers " In many cases the same manufacturer will sell direct in one district and sell through dealers in other districts Originally the selling was largely dealer selling. That was when the machine tools were simpler, and customers' requirements were less complex Now that the machines have been more highly developed more engineering selling has been called for, and there is a greater amount of direct selling, although there is still a very substantial amount of business done by dealers.

There is not much time or installment selling. The industry does not like long time accounts It is not unusual for a purchaser of machine tools to get two, three, four, or five months', or sometimes even a year's credit either from the dealer or the manufacturer, but there has been relatively little of what we know as "time sales" - sales with monthly payments over two, three, four, or five years

Price Policies - Effect on Demand In the machine tool industry price does not affect the demand very much A man wants a tool or he does not want it There is a very

quick upper limit to the price of machine tools but a drop in price has not been found to affect volume to the extent that in the low periods a distinct drop in price would produce business. That is because machine tools are a capital investment and when business goes down people do not want to invest dollars in capital improvements. They prefer to hold on to their dollars. The only time we sell machine tools is when people feel that they need them to get their product out in better shape or more cheaply.

There are no substitute processes competing with machine tools in the main Some parts that formerly were machined are now coin pressed or stamped, but the possible volume of such substitution is negligible.

To discuss the subject of foreign competition I have brought along a number of charts that were not gotten out by our office We furnished a good bit of the material and the Department of Commerce furnished more. Mr J E Lovely of Jones & Lamson Machine Company prepared these charts for a recent convention They are of interest from a good many different angles Chart 1 of the series shows foreign, domestic, and total orders for the years '31, '32, '33, '34, and '35. This chart was drawn from the source data used for Chart III

Chart 2 will give you an idea of the flow of exports only of machine tools from 1927 through 1936 Note that foreign business helped to break the shock of the early depression in 1930 and 1931, but by 1932 the foreign demand had receded materially

Chart 3 is a breakdown of the totals to show the distribution of machine tool exports by countries from 1927 through 1935 You will notice that Italy humped her purchases up in 1934. Note also Russia in 1930 and 1931. England has been buying heavily for the past two years.

Chart 4 shows the international exports of machine tools The United States leads, but Germany is a close second Switzerland is exporting a few of the fine tools, and France and England a few England, during the time that she has been buying our tools, has also exported some tools in order to maintain her foreign markets. That will be shown on another chart

In Chart 5 is the story of England's imports and exports of machine tools. You will notice that England exported a great many more machine tools than she imported from 1913 to 1925, and then they are fairly equal to 1931, when exports rose and imports fell. In that period the English government subsidized machine tool manufacturers largely for Russian shipments.

Chart 6 carries the story on by months from July 1935 to July 1936. In January of this year England started to import more machine tools than she exported but she is still maintaining her export market.

Chart 7 shows the United Kingdom's imports of machine tools from the United States as compared with all other countries.

Chart 8 tells the same story in another way, and shows more clearly the relative picture of the United States, Germany, and the smaller countries The machine tools exported from the United States to England account for little less than sixty per cent of England's imports, Germany, twenty-seven per cent, Switzerland, about six per cent, France, a little less than one per cent, Belgium, the same, the Netherlands, about two and one-half per cent, and Norway and Sweden, about nine and one-half per cent That will give you a pretty good picture of what England has been doing in the purchase of machine tools.

Chart 9 is an analysis of England's exports of machine tools To Italy, seventeen per cent, Australia, sixteen per cent, Russia, ten per cent, British India, eight per cent, etc I was interested in seeing what we might have imported - about one-third of one per cent

Types of machines imported by Great Britain from the United States during May and June of this year are shown in Chart 10 That gives an idea of the types of machines that England has been interested in

Chart 11 shows similarly the imports to Great Britain from Germany Note that imports of punch presses and shears represent nineteen per cent of Germany's exports to the United Kingdom, as compared to only four per cent for the

share of the United States. Germany has been specializing on some types of lathes and that probably accounts for thirty-two per cent of her exports coming under this classification.

Financial Structure What has occurred to the financial structure of the industry is well illustrated by Chart IV, made from a study of sixteen companies representing a fair cross section of the industry From 1929 to 1935 there was a shrinkage of forty-four per cent in the capital and surplus of these companies That is what the depression did to this particular industry You can see what a tax bill requiring the paying out of profits now will do to an industry such as ours. That is a very difficult problem for our industry to handle.

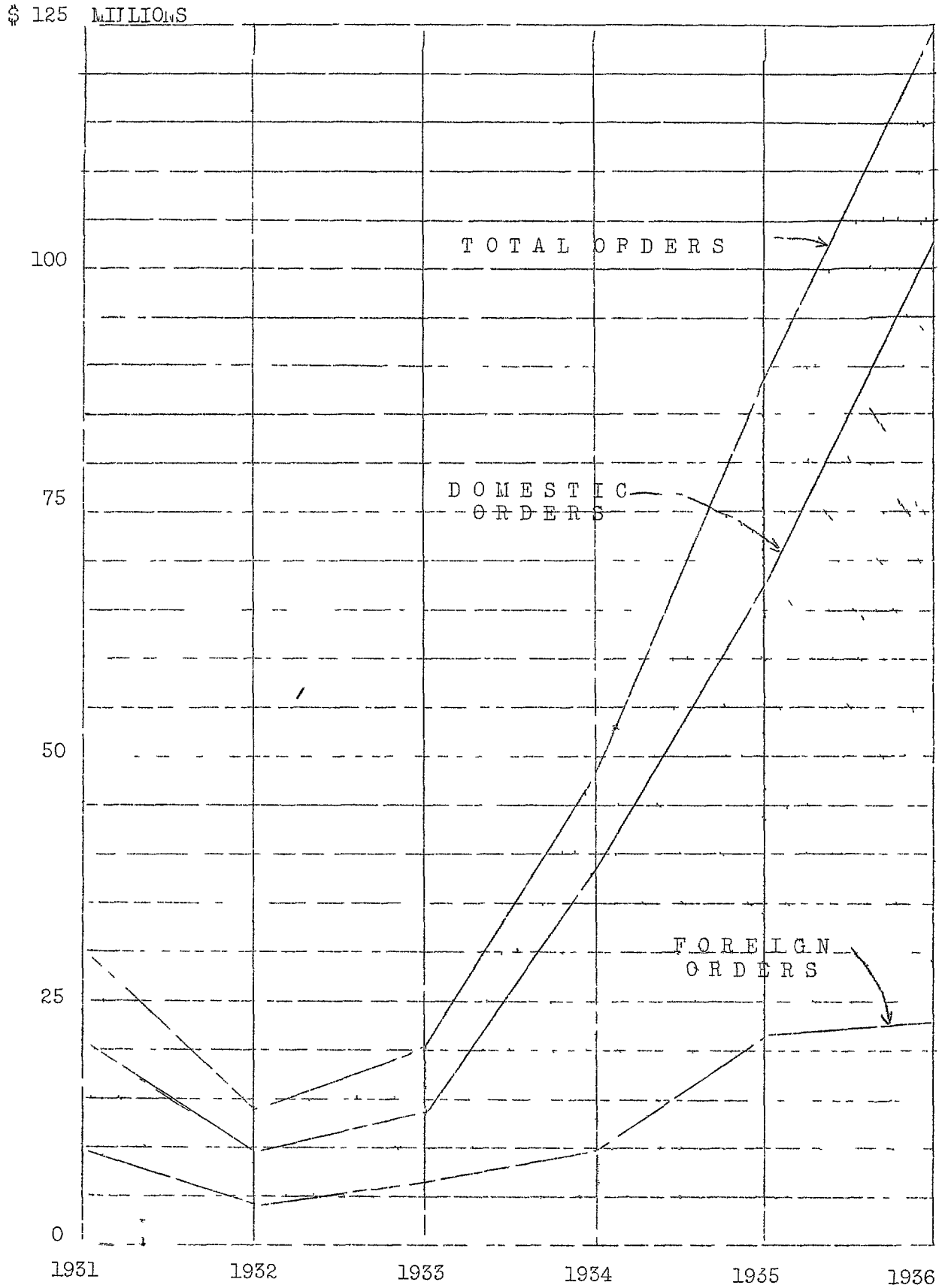
Chart V is a record of the profits and losses of the industry based on net worth, according to compilations made by the Robert Morris Association In 1919, the best year of record, the profit on net worth was twenty-five per cent, in 1920 it dropped to fifteen per cent, and in 1921 to a loss of 8.2 per cent, and so on The interesting point is that for these thirteen years the average profit on net worth has been five and eight-tenths per cent. With five and eight-tenths per cent profit in thirteen years on this type of business, it would be pretty hard to point out any excess profits in the industry As a matter of fact, if our people paid the dividends the investment is really entitled to they could not lay by the funds necessary for the development we are all interested in. The small average earnings of the industry confirm my statement that the people in our particular industry are interested in high achievement rather than in high earnings.

Railroad Repair Shops I want to make one point that I think tremendously important before I close, and that has to do with the railroad repair shops. The "American Machinist" study shows that railroad repair shops have the highest percentage of obsolete equipment. In an emergency the railroads would be called upon to take up the load almost immediately in the transportation of materials. They could not now begin to cope with the mass transportation that would be required. The railroad shops may be looked upon as the bottleneck in an emergency I do not think we can afford to overlook their condition because if locomotives and cars are not available in sufficient quantity and in good repair

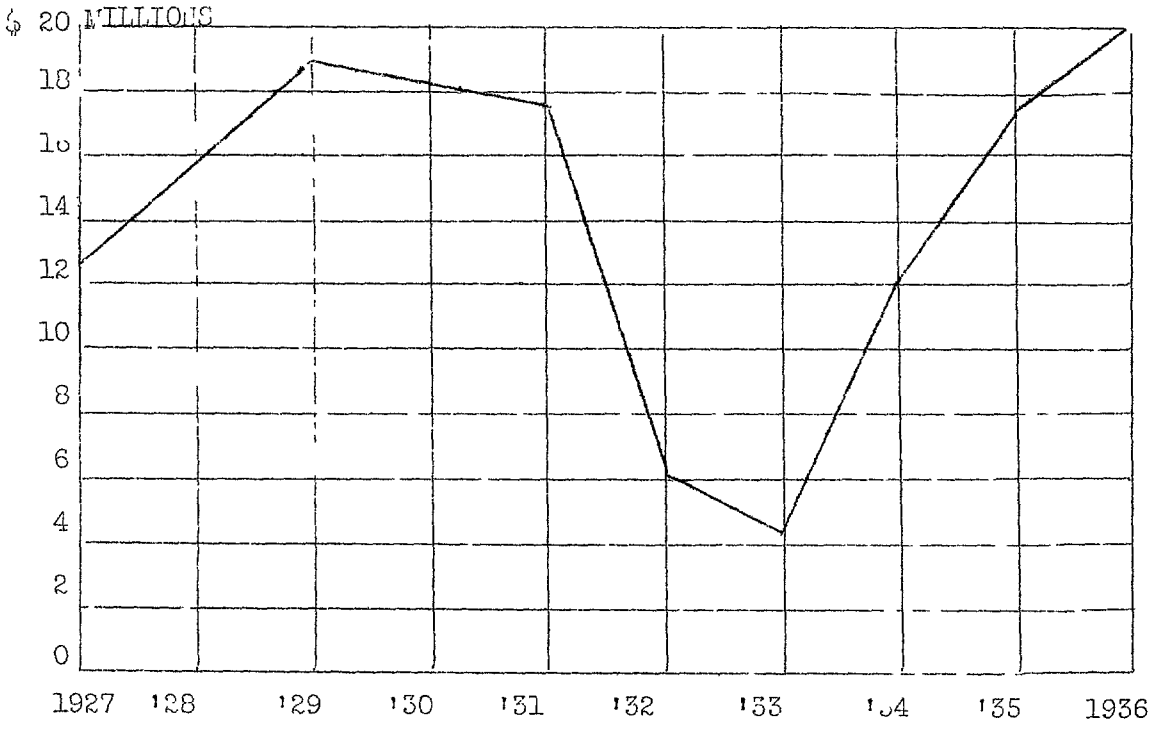
to furnish transportation, what the plants can turn out will not mean a great deal. I think that is a point which is not being given enough study by the railroads themselves at this time.

Our industry made a survey of the requirements of a typical repair shop about three years ago, and that study was the subject of the last report made by Coordinator Eastman before he closed his office. I would like to recommend that in all your studies and plans in connection with the manufacture of materials, some consideration be given to the transportation facilities for getting raw materials in and products out.

Chart No. 1

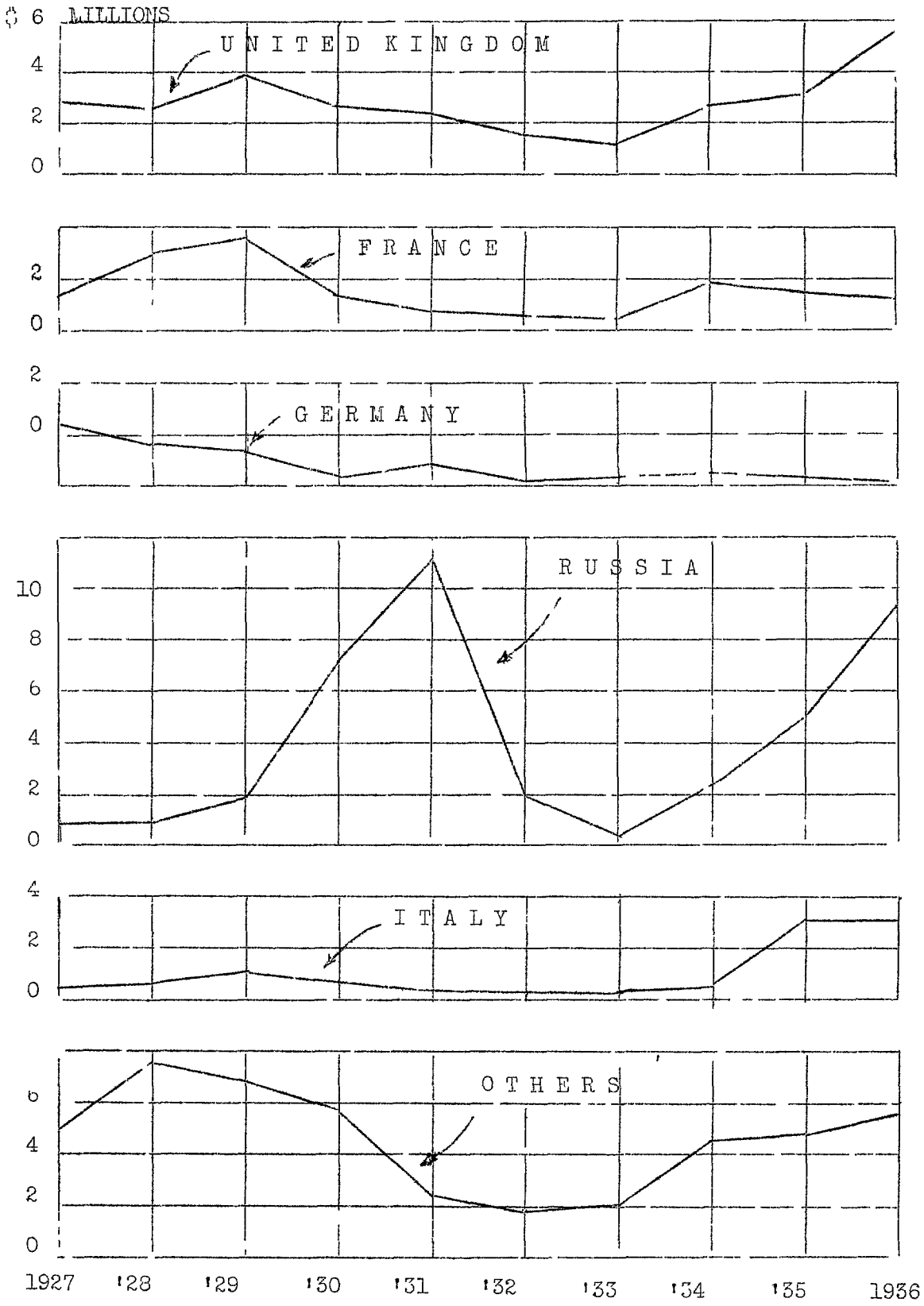


UNITED STATES ORDERS
FOR MACHINE TOOLS



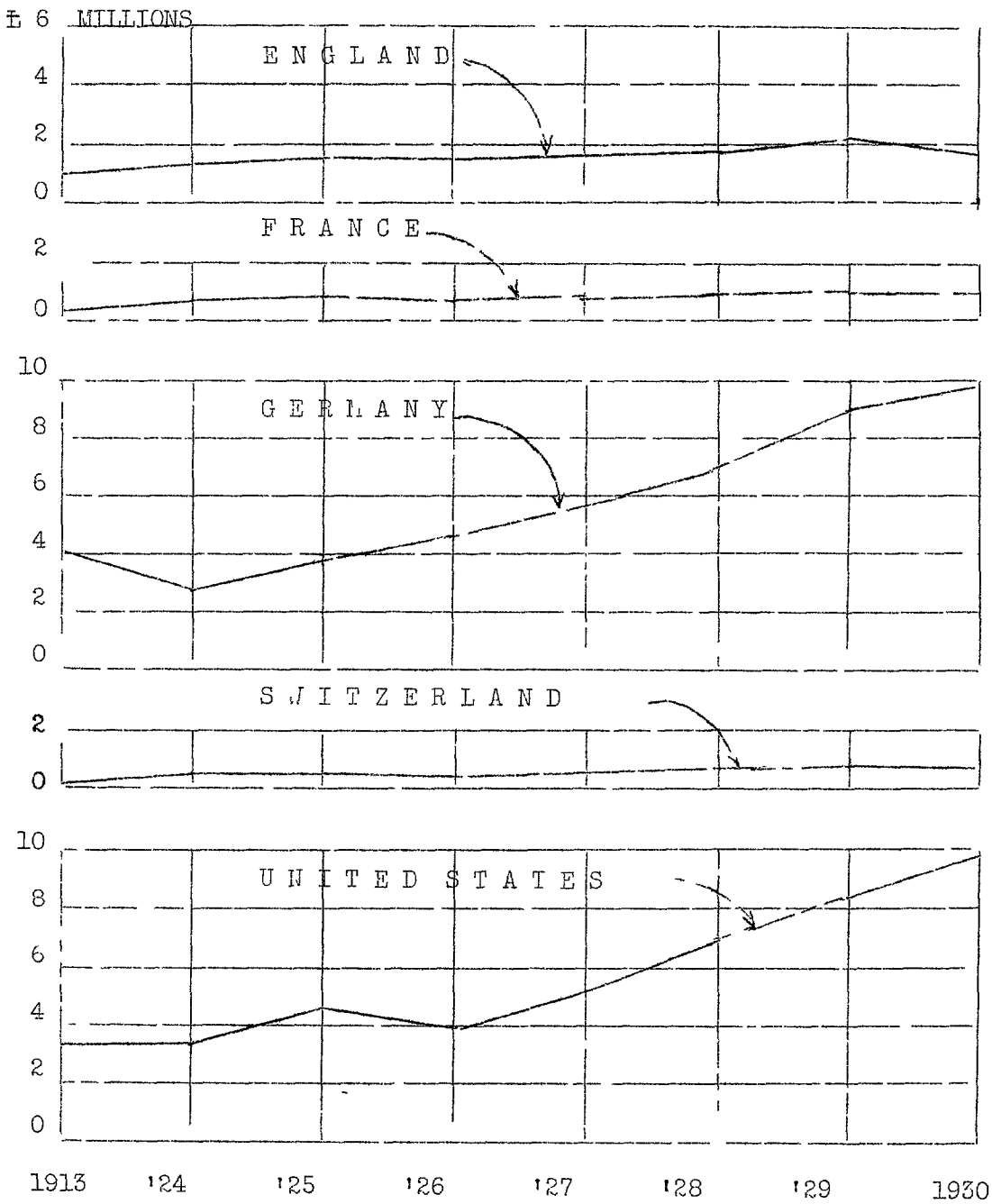
T O T A L
U. S. E X P O R T S O F M A C H. T O O L S

Chart No. 185



U. S. EXPORTS OF MACH. TOOLS

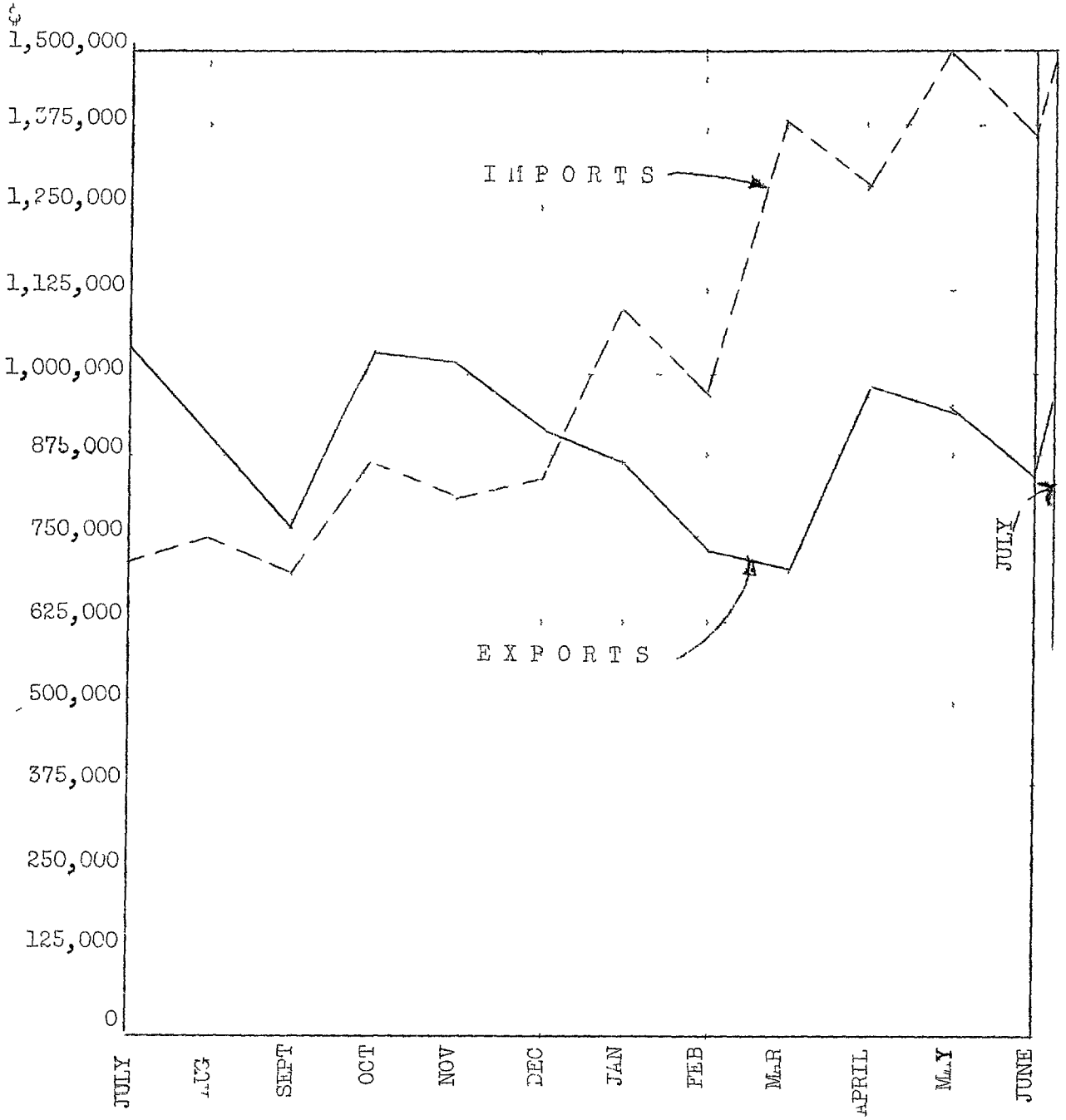
Chart No. 4



INTERNATIONAL EXPORTS
OF MACHINE TOOLS

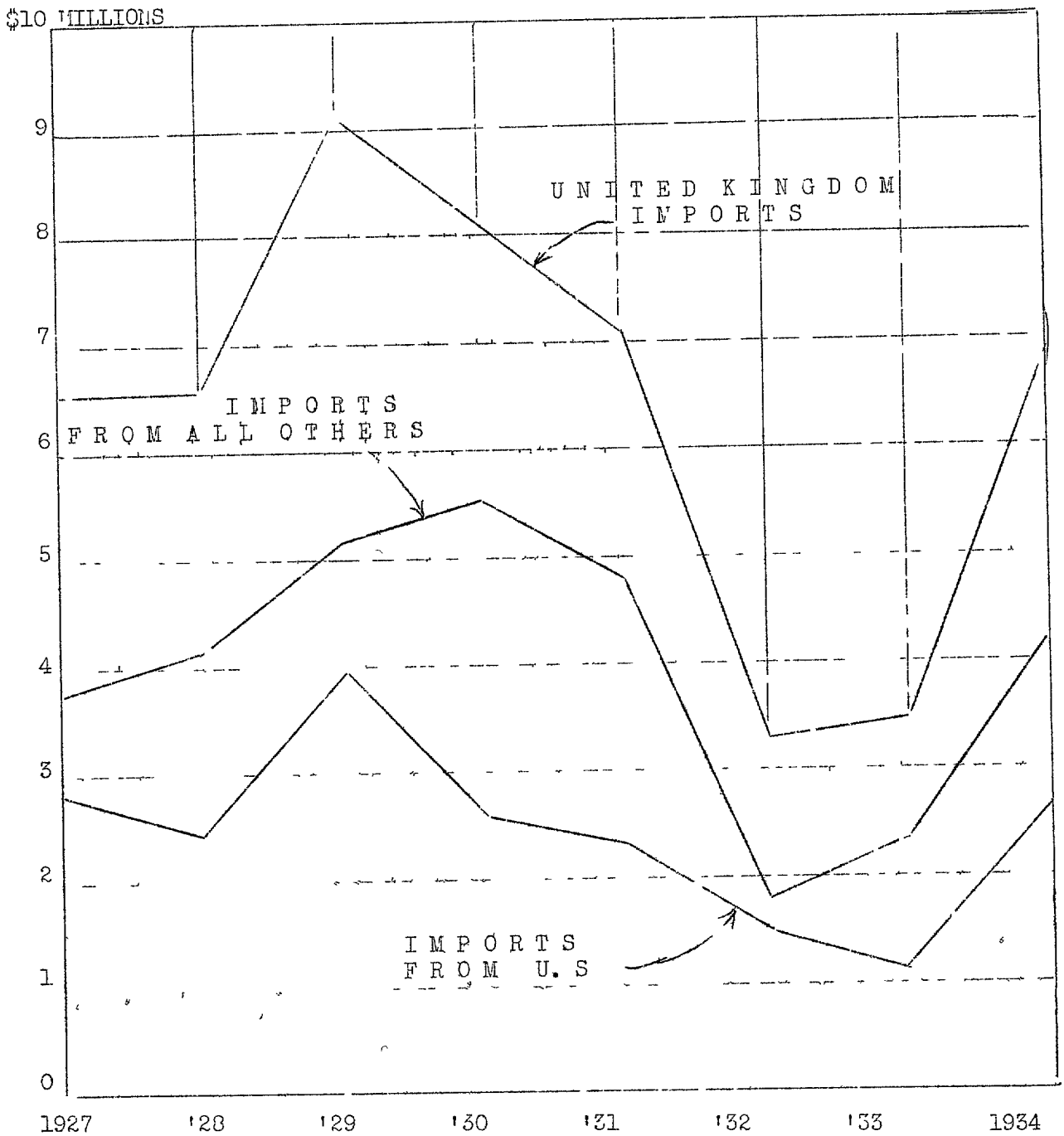
EXPORTS OF MACH. TOOLS
MANUF. IN UNIT. KINGDOM.
IMPORTS OF MACH. TOOLS
RETAINED IN UNIT. KINGDOM

Chart No. 188



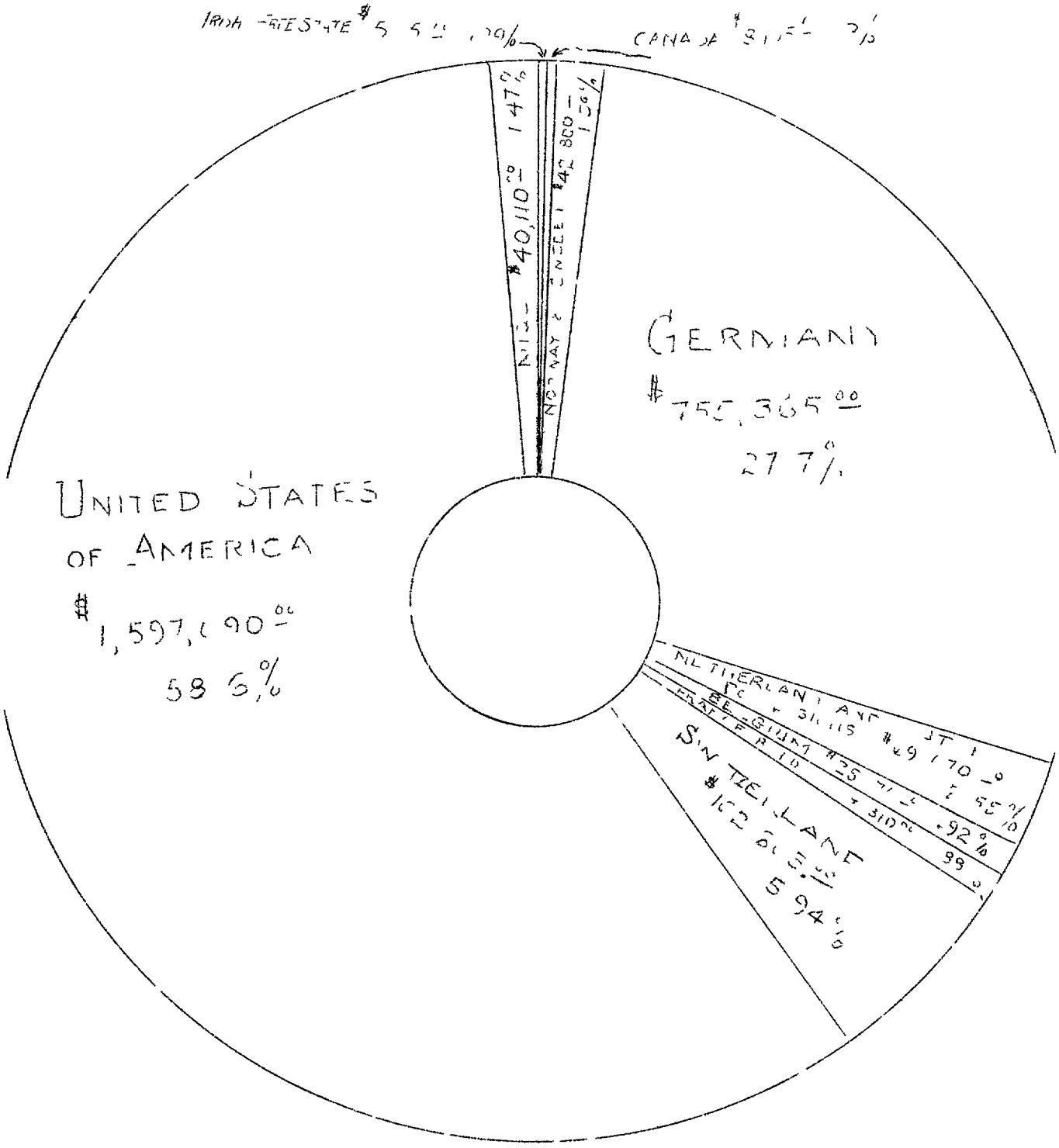
BRITISH EXPORTS AND IMPORTS
FROM JULY 1935 TO JUNE 1936

Chart No. 7



UNITED KINGDOM IMPORTS OF MACH. TOOLS FROM U.S COMPARED TO THEIR IMPORTS FROM ALL OTHERS

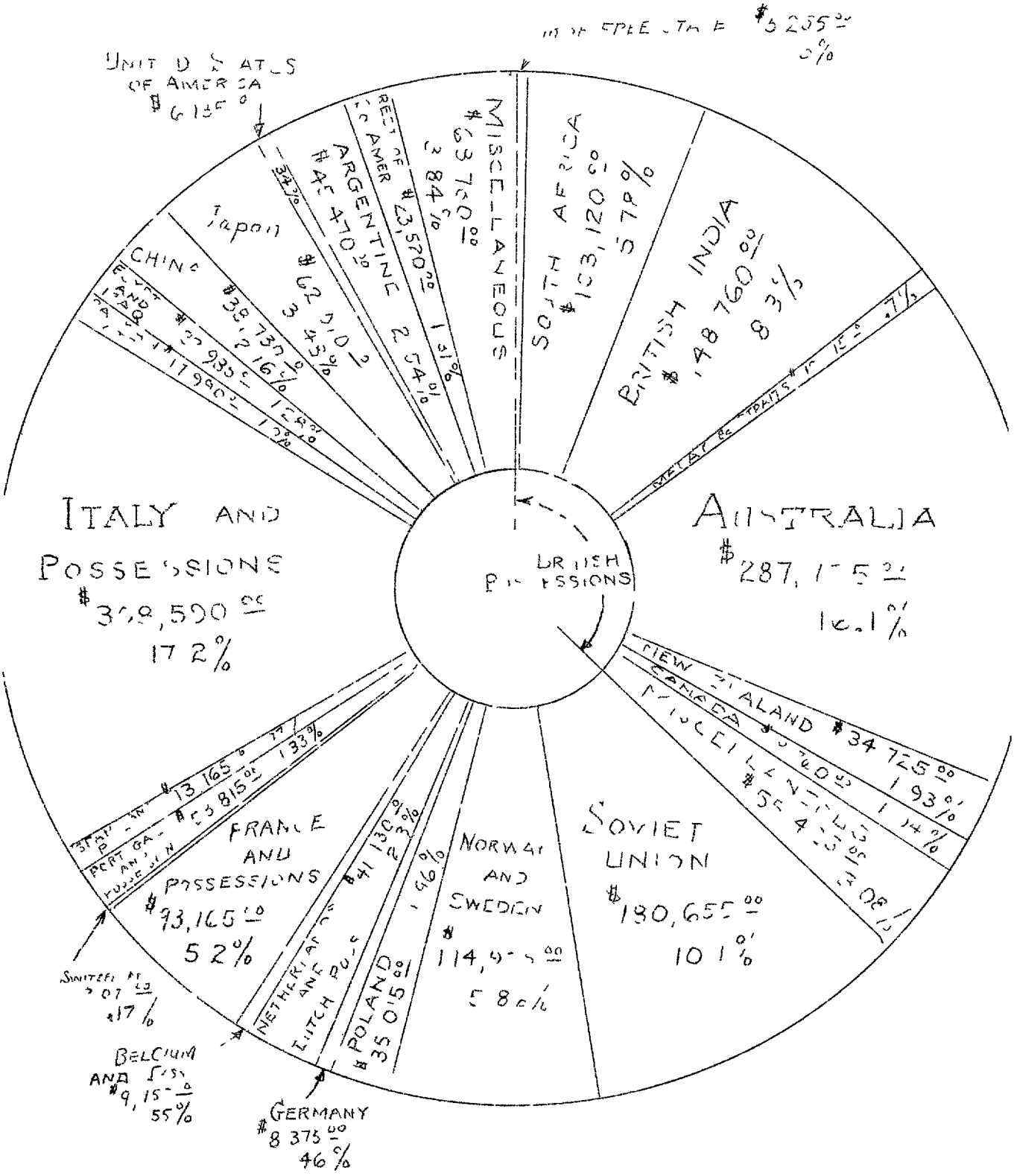
TOTAL VALUE $2 725,905



BRITISH MACHINE TOOL IMPORTS
MAY AND JUNE 1936

CHART No. 8

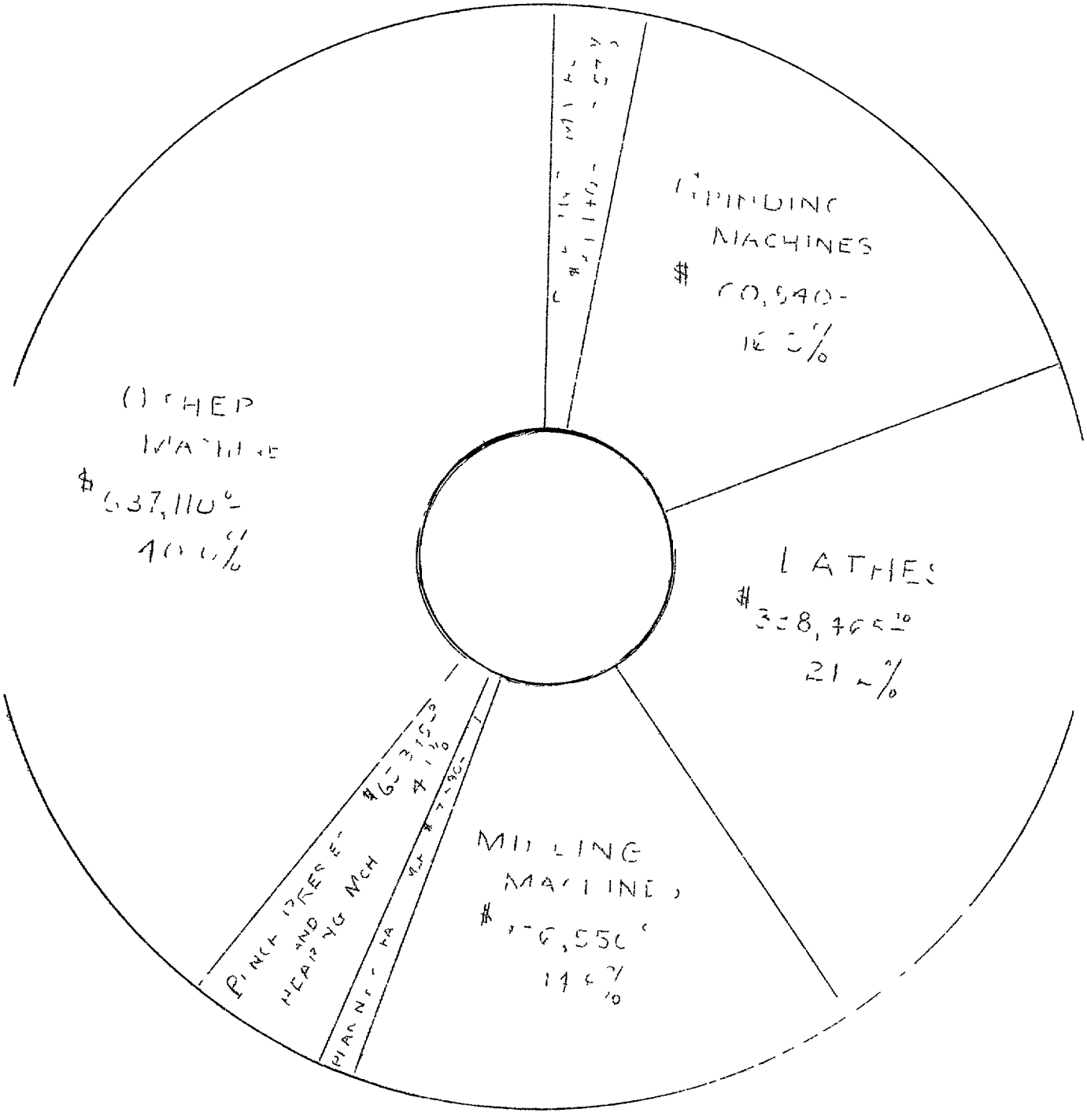
TOTAL VALUE $1,789,050



BRITISH MACHINE TOOL EXPORTS
MAY AND JUNE 1936

CHART No. 9

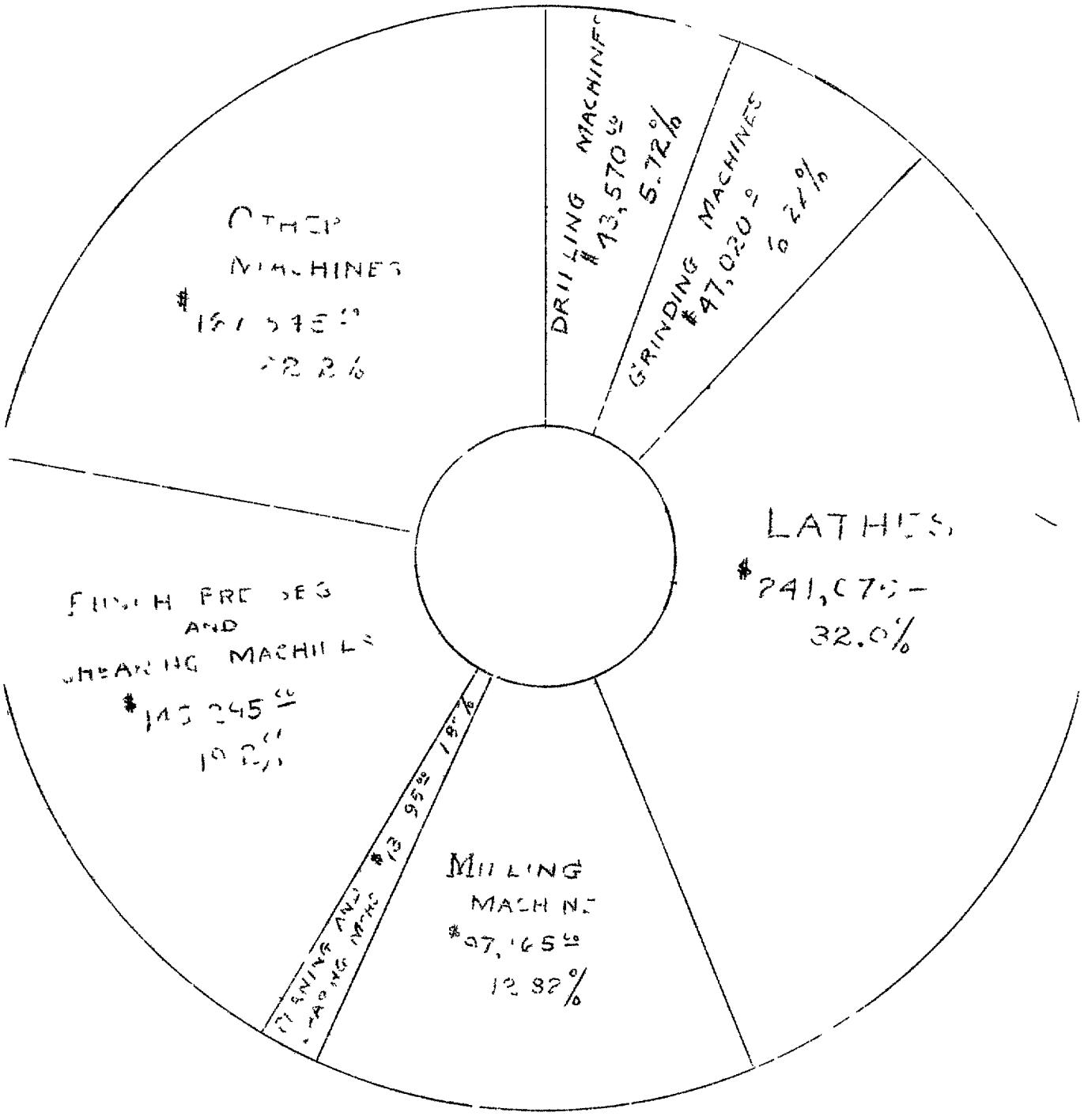
TOTAL VALUE $1,597,090.



MACHINE TOOLS IMPORTED INTO GREAT BRITAIN
FROM UNITED STATES
MAY AND JUNE, 1936

CHART No 10

TOTAL VALUE $755,365. 193



MACHINE TOOLS IMPORTED INTO GREAT BRITAIN FROM GERMANY MAY AND JUNE 1936

CHART No 11

CHART IV (1)

THE EFFECT OF BUSINESS CYCLES UPON FINANCIAL POSITION OF THE MACHINE TOOL INDUSTRY

Cross section of the Large Units of the Industry
Data compiled from reports of 16 companies

	1929	1932	1933	1934	1935
CURRENT ASSETS AT END OF PERIOD Cash, Accounts and Notes Receivable less reserves, Inventories less reserves, Securities at market	$34,824,158 100%	18,754,718 54%	16,895,72) 48%	15,022,815 43%	17,631,811 51%
FIXED ASSETS AT END OF PERIOD Land, Buildings, Machinery and Equipment less reserves and depreciation	$20,557,347 100%	16,195,485 79%	14,965,088 73%	15,143,747 74%	15,665,968 76%
CURRENT LIABILITIES AT END OF PERIOD Accounts Payable, Borrowed Money, Taxes Accrued and Payable, Accrued Payrolls and Dividends declared and payable	$ 5,760,345 100%	3,869,473 67%	3,270,887 57%	3,750,523 65%	4,074,801 71%
CAPITAL AT END OF PERIOD Common and Preferred Stocks at par or declared value, Capital Notes and Bonds. SURPLUS ACCUMULATED CAPITAL AND SURPLUS (COMBINED)	$30,195,006 $21,270,423 $51,465,429 100%	24,423,018 8,666,831 33,089,849 64%	20,576,128 8,248,588 28,824,716 56%	20,540,783 7,022,572 27,563,355 54%	20,519,127 8,578,635 29,097,762 56%
NET PROFIT OR LOSS	$ 9,511,530	L4,086,833	L2,783,618	2,141	1,546,028
SALES	$52,592,492 100%	6,887,748 13 1%	7,048,741 13 4%	15,559,713 29 6%	23,787,306 45 2%
WAGE EARNERS SALARIED EMPLOYEES (Exclusive of Officers)	10,319 1,662 100%	2,581 830 28.5%	2,660 750 28 5%	4,399 894 44.2%	6,665 1,210 65.7%
TAXES PAID County and Municipal, State, Federal	$ 1,854,906 100%	437,424 23.6%	401,534 21.6%	485,523 26 2%	829 501 44 7%

Compiled for presentation to Senate Finance Committee Hearing on the 1936 Tax Bill, May 8, 1936

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CHART IV (2)

THE EFFECT OF BUSINESS CYCLES UPON FINCNAIAL POSITION OF THE MACHINE TOOL INDUSTRY

Cross section of the Smaller Units of the Industry

Data compiled from reports of 16 companies

	1929	1932	1933	1934	1935
CURRENT ASSETS AT END OF PERIOD					
Cash, Accounts and Notes Receivable less reserves, Inventories less reserves Securities at market	$ 4,259,327	3,198,887	2,914,131	2,875,630	2,936,389
	100%	75%	68%	67%	69%
FIXED ASSETS AT END OF PERIOD	$ 2,625,546	2,302,836	2,084,022	1,916,487	1,887,555
Land, Buildings, Machinery and Equipment less reserves and depreciation	100%	88%	79%	73%	72%
CURRENT LIABILITIES AT END OF PERIOD					
Accounts Payable, Borrowed Money, Taxes accrued and Payable, Accrued Payrolls and Dividends declared and payable	$ 913,799	990,992	745,155	782,431	687,896
	100%	108%	82%	86%	75%
CAPITAL AT END OF PERIOD					
Common and Preferred Stocks at par or declared value, Capital Notes and Bonds	$ 4,090,915	4,028,871	3,960,721	3,656,316	3,687,976
SURPLUS ACCUMULATED	$ 1,774,573	868,310	551,755	473,088	482,186
CAPITAL AND SURPLUS (COMBINED)	$ 5,865,488	4,897,181	4,512,476	4,129,404	4,170,162
	100%	83%	77%	70%	71%
NET PROFIT OR LOSS	$ 1,263,496	L 605,698	L 352,767	L 42,275	87,170
SALES	$ 8,005,325	1,129,533	1,006,573	2,466,636	3,617,241
	100%	14 1%	12 6%	30 8%	45.2%
AGE EARNERS	1,285	360	356	648	922
SALARIED EMPLOYEES	244	164	140	168	199
(Exclusive of Officers)	100%	34 3%	32 4%	53 4%	73 3%
TAXES PAID	$ 211,877	61,532	58,495	72,313	80,415
County and Municipal, State, Federal	100%	29%	27 6%	34 1%	37 9%

Compiled for presentation to the Senate Finance Committee Hearing on the 1936 Tax Bill, May 8, 1936

SALES, EMPLOYMENT AND TAXES

EXPERIENCE OF 32 COMPANIES IN PERCENT OF 1929

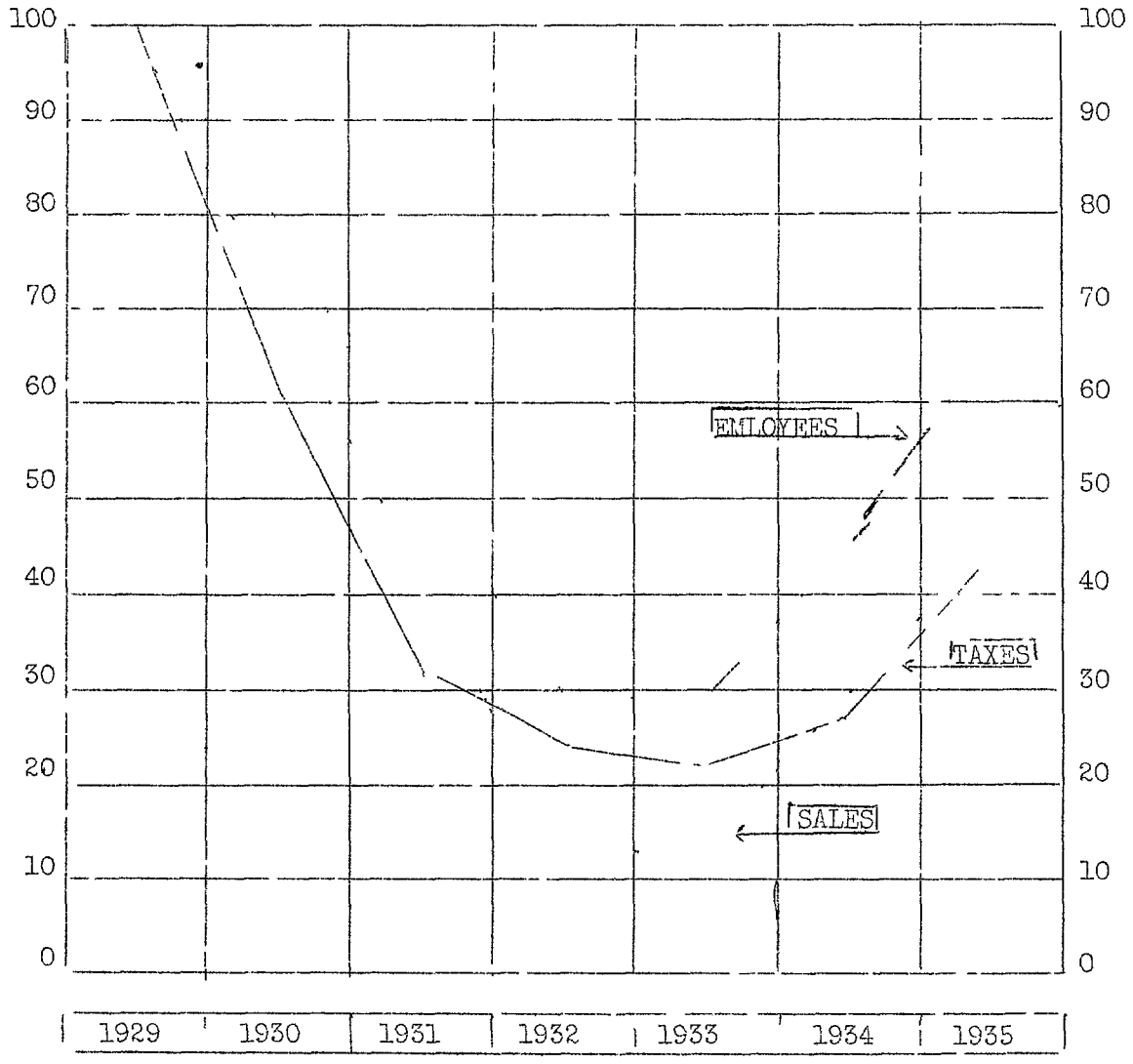

Chart IV(3)

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CHART V

PROFITS OF THE MACHINE TOOL INDUSTRY IN PERCENTAGE OF NET WORTH

Study by Robert Morris Associates
Approx 30 Representative Companies

YEAR	PER CENT P / NW
1919	25.7
1920	15 7
1921	8.2
1922	3 6
1923	9 2
1924	2 8
1925	7 8
1926	9.5
1927	6 4
1928	18 3
1929	13.0
1930	1 9
1931	14 0
1932	11 0

Reports are from identical companies for 1919 to 1928 inclusive, thereafter for varying number

→ Figures in Red

INDEX OF ORDERS
FOR MACHINE TOOLS

AVERAGE MONTHLY SHIPMENTS OF 1926 =100% 3 MONTHS MOVING AVERAGE PLOTTED ON CENTER MONTH NATIONAL TOOL BUILDERS ASSOCIATION

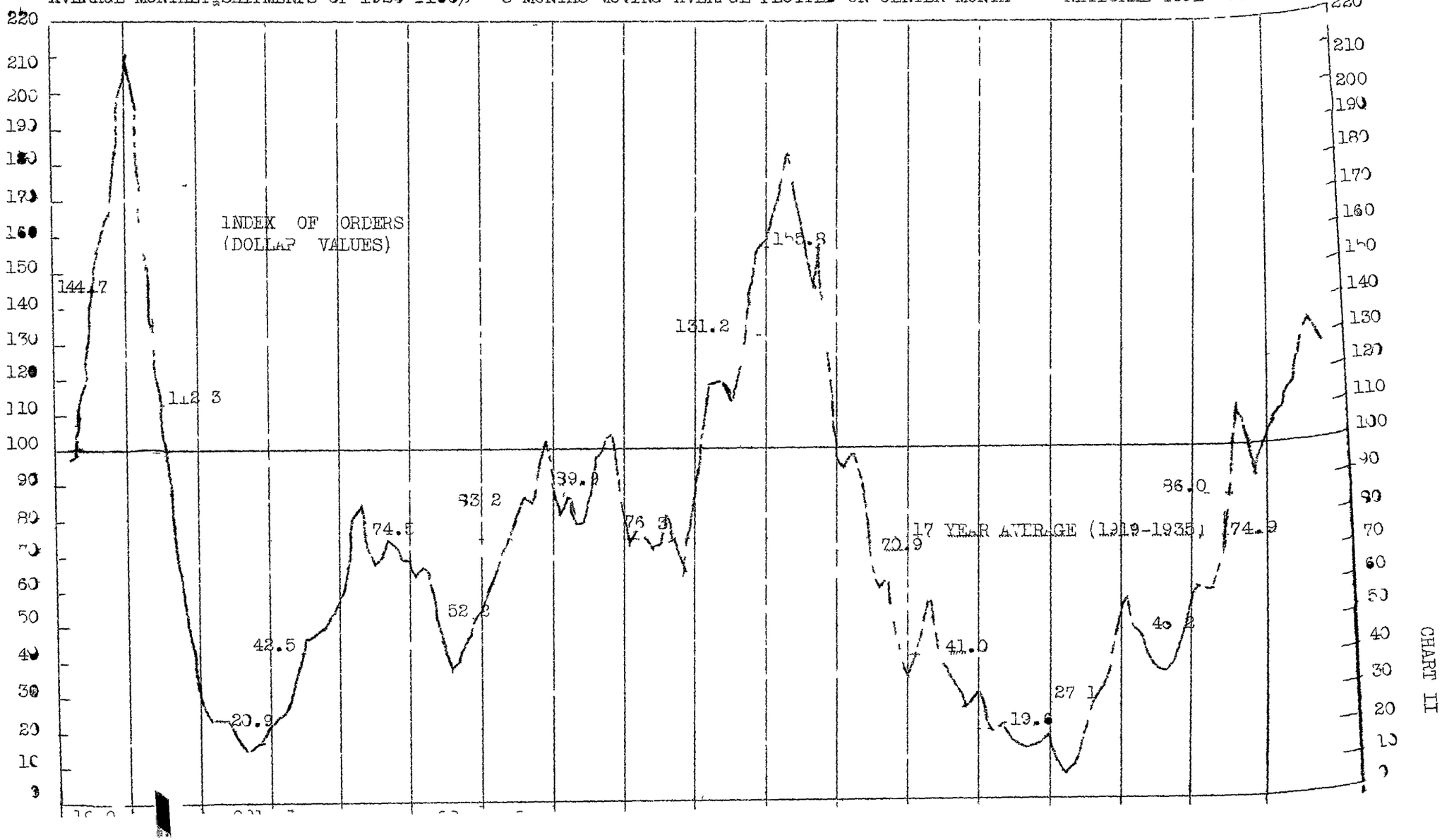


CHART II

INDEX OF ORDERS
FOR MACHINE TOOLS
DOMESTIC AND FOREIGN

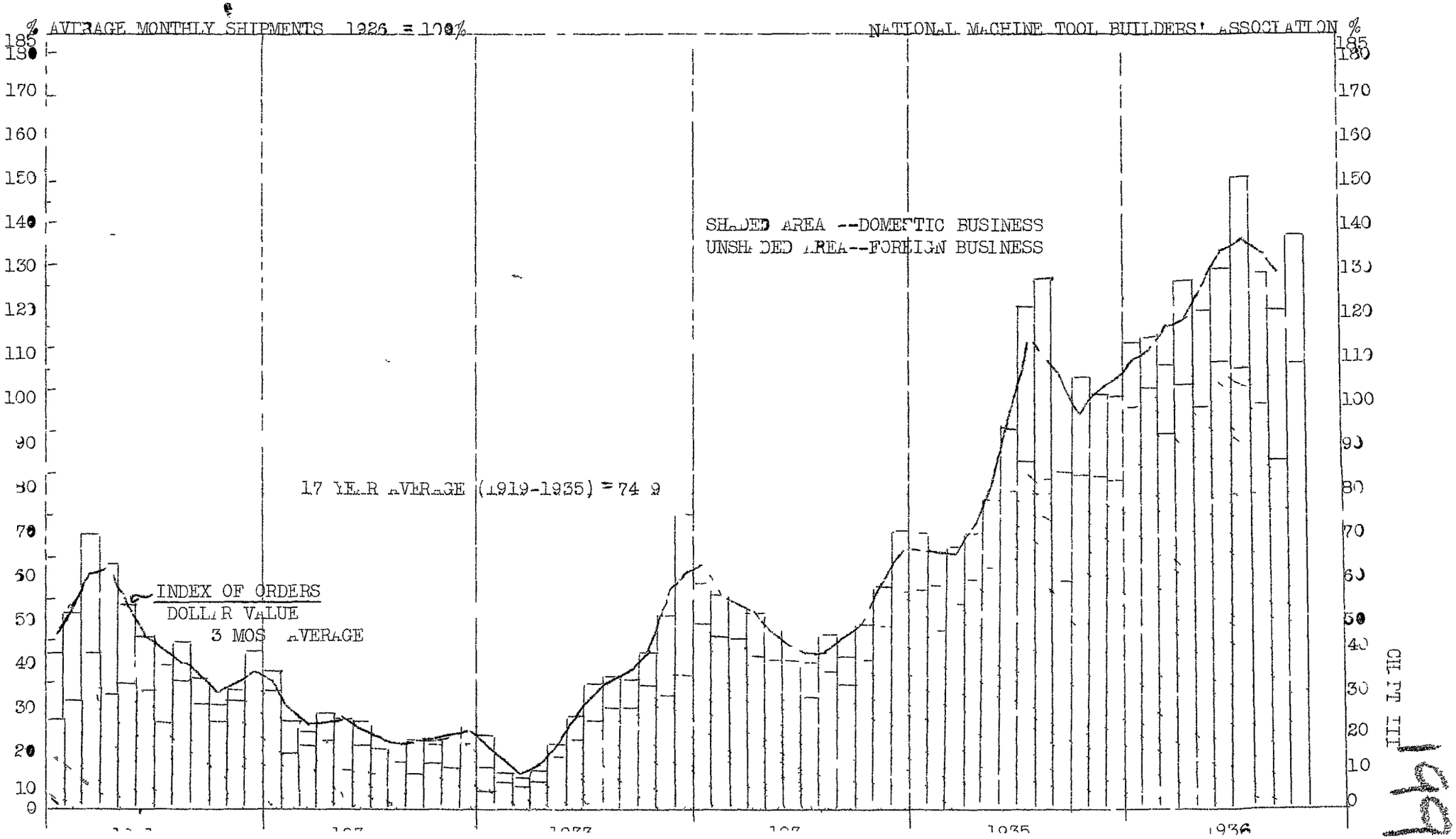
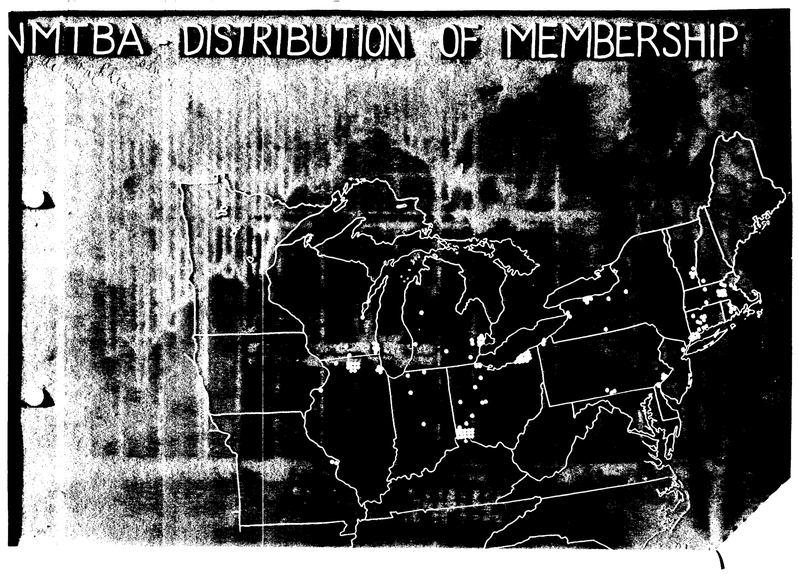


CHART III


NMTBA - DISTRIBUTION OF MEMBERSHIP