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*Tool / and / machine tool
industry*

MACHINE TOOL AND TOOL INDUSTRY
OF THE USSR^{1/}
by
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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

The Soviet machine tool and tool industry is a complex branch producing basic technological equipment (metal cutting machine tools, forging and cutting equipment), tools (metal, abrasive and diamond) for mechanical engineering and instrument making industry as well as various kinds of measuring instruments.

Practically, Soviet machine tool industry, like many other branches of mechanical engineering, was founded and developed during the years of the Soviet Power.

During all the elapsed decades, the socialist planned economy worked out by the founder of the Soviet State, V.I. Lenin, has provided the balanced and proportional development of all the branches of national economy, great attention being paid to the outstripping development of the leading branch of industry - mechanical engineering.

Now, in the USSR, as well as in other industrially developed countries, more than one third of all employed in industry work in mechanical engineering, which is called by right the heart of basic industry. Continuous improvement of methods for producing machines, instruments, equipment and tools is an important problem of increasing the labour productivity and national income. This task should be solved by machine tool builders.

Now, as a result of socialist transformation, the Soviet industry numbers over 3.3 million metal cutting machine tools, 730 thousand forging equipments, tens of thousands of various casting machines.

PRODUCTION OF METAL WORKING MACHINERY

The rational use of raw materials and semi-finished products is an important index of technical level of machinery production. It is well-known that the cost of metal in mass and large scale production is 50 percent higher than the cost price of products. Therefore, great attention is paid to the development of the equipment producing so-called accurate blanks which reduce the minimum subsequent metal cutting.

During the recent years in the Soviet Union, the production of forging equipment is developing more rapidly than that of metal cutting machine tools. Now the output of forging equipment is over 42 thousand pieces a year. More than 800 types of various machines are put into production. Almost all kinds of automatic headers and sheet metal stamping presses are manufactured at the Soviet enterprises, among them are powerful hydraulic and mechanical presses, including the largest in the world hydraulic press of 75,000 tons capacity, bar-profile presses up to 12,000 tons capacity, eccentric shaft hot stamping presses from 530 to 8,000 tons

capacity, mechanical sheet metal stamping presses from 1 to 1,000 tons capacity, coining presses up to 4,000 tons capacity and other metalworking machinery. Various kinds of equipment for cutting and bending of metals, cold and hot three-dimensional stamping, etc. are produced in large quantities.

All the efforts of Soviet scientists and production workers are concentrated on finding means for further increasing the efficiency of shaping methods and the accuracy of finished parts.

Rather a perspective trend is the production of machines using high powers (working speeds) and higher specific pressures. Extremely widespread are multiple-station machine tools, automatics, combines and automatic transfer machines which enable to perform the whole complex of operations connected with the machining of blanks. Proceeding from the specific features of metalworking production, considerable efforts of designers and production workers are aimed at increasing the level of automatization of machines, use of remote automatic control, especially for large machines intended for hot three-dimensional stamping.

In the recent years, NC systems have found a wide application, first of all, in punch presses, nibbling machines, tube-bending and sheet-bending machines and others. The use of carbide dies produced on NC EDM machines assists in obtaining accurate blanks by cold three-dimensional and sheet metal stamping in particular.

In the nearest future the output of metal forming equipment in the Soviet Union is supposed to be 22-25 percent of the total output of metalworking machinery. The range of machines to be produced will be widened and renewed.

PRODUCTION OF CASTING MACHINES

The Soviet production of casting machines as well as this branch in other countries is comparatively new, it was developed during the last decade. The use of recent advances of chemistry enabled to radically change the nature of casting processes and to turn from conventional sand casting technology to the production of castings with accuracy. $.1 - .2$ mm and high surface finish that almost completely eliminated machining processes.

In the Soviet Union the production of equipment for die shell casting by the lost-wax process, spun casting in permanent moulds as well as multilayer ones is developing more intensively than the production of casting equipment as a whole. The specific feature of these types of equipment is their integrity. Depending on the scale of the production according to an economically justified number of

capacities, the total complex of equipment required for carrying out the whole technological process is worked out and produced.

New methods of producing castings in expendable moulds with the use of fluid moving mixtures developed by the Soviet scientists are widely applied in the Soviet Union and abroad. The use of fluid moving mixtures considerably reduces the duration of technological cycles, raises the productivity of labour 2.5 or 3 times, improves the quality of casting. Perhaps, nowhere in mechanical engineering there is such an acute necessity of increasing in every possible way the level of mechanization and automatization as well as the integral decision of this task as in the casting production characterizing by the high-temperature and dusty conditions and requiring great physical efforts of workers. It is true that this branch of mechanical engineering is considered to be the most difficult and harmful. It should be noted that both the Soviet Union and other countries have not yet found the integral decision of effective mechanization and automatization of all the technological processes of casting production, especially in sand-casting. Great efforts are needed to find effective methods of fettling and chipping the castings. The basic industry dealing with the whole complex of questions connected with the casting production gives all the possibilities for comparatively fast solving all the technical and industrial problems concerning the development of mechanical engineering.

MACHINE TOOL INDUSTRY

Investigations carried out by scientists as well as the analysis of practical activities in the field of mechanical engineering show that despite the intensive improvement of methods for blank production, particularly with regard to enhanced accuracy of the product, the share of mechanical engineering is not practically reduced. It results from the fact that parallel with the reduction of time required for removing rough machining allowances, considerable time is spent on finishing operations. In mechanical engineering and instrument making industry in particular, accuracy requirements are becoming more stringent, therefore, in machine tool industry there is something like shifting in the kinds of machining, on the one hand, the systematic reduction of roughing processes and subsequently the decrease in the amount of equipment used for this purpose on the other hand, the intensive increase in the amount of equipment used for precision operations, mainly for abrasive ones.

The output of metal cutting machine tools in the Soviet Union exceeds 200,000. Only more than one thousand and a half models of various metal cutting equipment

covering practically all the necessary assortment are put into series production. On the Soviet metal cutting machine tools it is possible to produce parts sized from fractions of millimeters to tens of meters. At present, over 350 models of only heavy-duty and unique machines are produced including vertical turret lathes handling workpieces up to 22 m, lathes accepting parts with 6 mm diameter and 12 m long and so on.

In the assortment of metal cutting equipment to be produced, precision machine tools amount to 40 percent, while automatics and semi-automatics total over 60 percent. The share of precision machine tools, automatics and semi-automatics in the total amount of machine tools is ever increasing. Soviet machine tool builders have gained a rich experience in the production of automatic transfer machines. This work started as far back as in pre-war years has now received a wide industrial development.

Now over 3,000 automatic and semi-automatic transfer machines are employed at the Soviet industrial enterprises. Alongside the conventional transfer machines consisting of unit-type machine tools for handling frame parts greater amounts of automatic transfer machines for machining various shafts and gears are supplied to the industry. Soviet machine tool builders have done a great deal of work on providing bearing and other branches of industry with complex automatic transfer machines. The solution of the problem on organizing the production of various types of metal cutting equipment required great efforts, the creation of specialized enterprises to produce heavy-duty machine tools, as well as enterprises with specific climatic conditions to produce high precision machine tools. The production of high precision machine tools demanded that families of unique metal machine tools should be built to provide basic parts for precision equipment.

The solution of the problem concerning the use of automatic NC equipment acquires greater and greater importance for effective automatization of series production, the share of which is now about 70 percent of the whole volume of production in mechanical engineering and which will not considerably change in the nearest decade. In spite of the intensive specialization and co-operation. Now in the Soviet Union over 60 models of NC machine tools and tens of models of machines with plug-in control systems for performing various technological operations are put into production. Reliably and comparatively cheap machining centres are intensively developed. The work on improving the methods of automatization of certain types of equipment is organically combined with the work of producing semi-automatic and automatic transfer machines, complexes and automatic management control systems with the use of computers, NC address stores, etc.

TOOL INDUSTRY

The specific feature of the Soviet specialized tool industry is the high level of concentration of tool production.

Tool making plants with average annual employment of 2,000 produces almost half of the total amount of tools, i.e. 46.3 percent. Both by employment and the number of equipment which is used such machine tool works as the "Fresor" producing cutting tools and the "Kaliber" producing measuring tools are the largest in the world tool making plants.

The high level of concentration combined with specialization allowed the tool making plants to organize the production of metal cutting tools by using methods of large scale and mass production. The tool making plants successfully employ automatic transfer machines and mechanized production lines, high capacity automatic and semi-automatic equipment for mechanical machining, heat treatment and checking up.

Soviet tool making plants provide a broad range of tools required for diversified mechanical engineering.

Special attention was given to the development of carbide tool production. Recently various designs of cutters, mills and other tools have been worked out on the principle of mechanical fixing of circular and multi-edge carbide tips. Tens of millions of such tips for tools of this type are produced every year.

Many kinds of small sized solid carbide tools such as drills, reamers, taps, end mills, boring and milling cutters for machining complicated profiles, disk cutters and others are manufactured. Those tools are of great demand not only in our country, but also abroad.

To the most important trends of the further development of tool production in the USSR we may refer to the following ones:

- assimilation of new and improved tool materials enhancing the quality and life of cutters;
- development of absolutely new effective designs of tools for gear-turning, spline-turning and other new processes.

For automobile industry in particular, it is envisaged to develop and master the production of new standard quick-changeable tools of high efficiency, normalized cutting elements and tooling for transfer machines, automatics and NC machine tools to provide predetermined cutter life, minimum time for tool changing and high accuracy of setting-up.

The production of high quality grinding materials and abrasive tools is organized in the Soviet Union at large specialized enterprises.

In the nearest future we plan to build a considerable number of new tool-making plants and substantially increase the output of tools that enables us to meet the ever-growing needs of our industry.

PRODUCTION OF DIAMONDS AND DIAMOND TOOLS

Now the Soviet Union takes one of the first places in the world by the production and use of diamond tools in industry.

Our country has a rich raw material base for the production of diamond tools; from year to year there is a steady increase in the output of natural diamonds, the quantity of diamonds extracted is sufficient for a wide range of diamond tools to be manufactured; a large industry producing synthetic diamonds is developed at the present level, the perfection of technology allows to continuously improve the quality of diamond tools and expand their application.

Diamond tools are manufactured by specialized plants. At present the production of diamond tools in various kinds, types and sizes is organized including diamond grinding wheels on organic, metal and sintered bonds for machining all kinds of materials, among them are hard alloys, sintered materials difficult to machine, glass, semi-conductor materials, high alloyed and heat resisting steels and high temperature alloys.

Soviet tool making plants also produce diamond tools for finishing work, honing stones, lapping tools, superfinishing tools, various pastes, boring tools (such as chisels, bits, expanders); drills for making holes in difficult to machine materials, as well as in reinforced concrete used for construction and repair work. The range of products at these plants also includes single crystal tools, namely: fine wire draws, cutters for boring workpieces made of non-ferrous metals and alloys, tips for control measuring and in-process checking instruments.

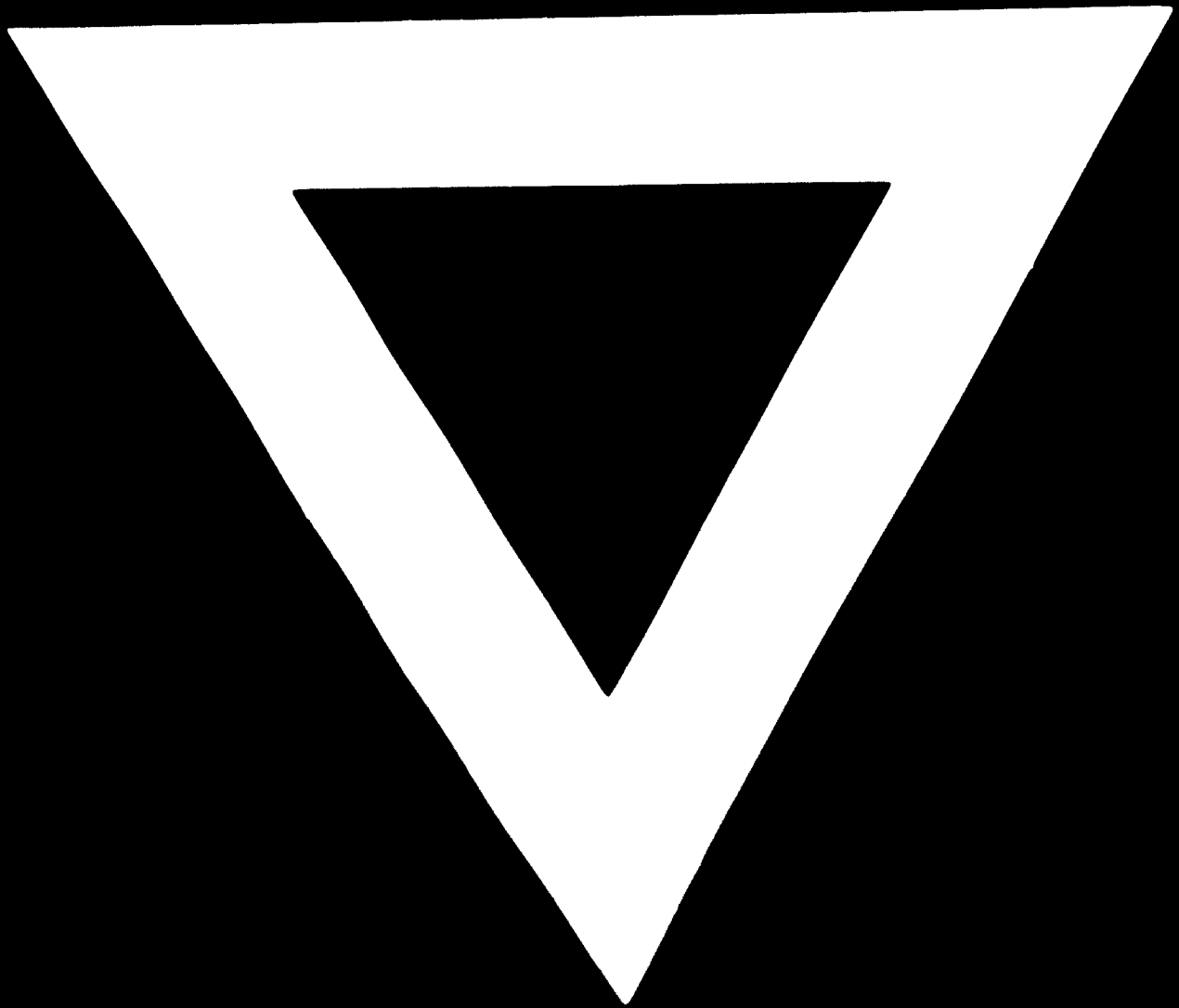
Soviet scientists have created now, rather hard material of high quality - "Elbor", which successfully competes with diamond tools in many processes. Various kinds of tools are being made of "Elbor". The intensive and balanced development of the Soviet machine tool and tool industry as well as the systematic increase of its technical level in tactical and strategical lines are based not only on the availability of the centralized management, high skilled workers and engineers, rich material resources, but also on the availability of the well-developed system of scientific research institutions, projecting and designing

institutes, departments and other engineering organizations. Almost all branches of machine tool and tool industry have their own scientific research institutes with powerful experimental bases. The works carried out by ENIMS, ENIKMASH, VNILASH and other scientific research institutes are well-known all over the world.

The planning of new enterprises in machine tool and tool industry is being made by specialized designing institutes having at their disposal highly trained specialists who in planning new industrial enterprises envisage a considerable leap in their qualitative development and the level which should be obtained when putting these new enterprises into operation. Large design departments under the guidance of the leading scientific research institutes are working out wide families of ranges of unified machines, the specialized production of which is organized not only as a whole but also with separating the production of certain units and mechanisms. Object and technological specialization gives all the possibilities to organize the output of certain types of parts in comparatively small batches on the principles of large scale and mass production. Thus, for instance, in machine tool industry over 60 percent of all the equipment and machines are manufactured with the use of methods of flow-line and mechanized production. Specialized industrial technological institutes having at their disposal highly skilled specialists render a great assistance to enterprises in the complex development of technological processes and in training specialists when new production is assimilated. Orgstankimprom and other institutes of that kind are well known.

Having a powerful raw material and industrial base, the Soviet Union naturally strives to secure a full economic independence. This refers to machine tool and tool industry as well. In this connection, Soviet specialists and administrative workers are well aware of the fact that technical progress and especially those changes which are taking place now in the production character are impossible without taking into account the world experience and without reasonable exchange of goods. Thus, it is estimated that in machine tool industry the range of equipment required for meeting all the demands connected with the development of machine tool production accounts for about 5,000 models, while in metalworking machinery it amounts to more than 1,800-2,000 models. Not a single even highly developed country can keep the production of this range of equipment at the highest technical level. Therefore, at this stage of industrial development, as never before, it is very important to establish close co-operation and carry out mutually profitable exchange of goods in producing of which this or that country has obtained the best results in comparison with the others.





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