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MACHINE TOOL BUILDING IN THE USSR

The following article from the Swiss newspaper, Technische Rundschau, on the Soviet machine-tool industry included information obviously drawn from the Soviet periodical, Stanki i instrument, No 11, November 1947. Since information from this Soviet periodical was previously published, items reappearing in the Swiss newspaper were omitted from this report. Special attention is called to the explanation of "Aggregate Machines."

In the course of annual machine-tool exhibitions and numerous conferences in the USSR, a lively exchange of experience and a standardization of construction and development aims have been accomplished. The development stages can be chronologically enumerated as follows:

1. At first, production of the best possible copies of foreign models, including the processes and the tools used. E.g., the first Maag thread chasers were built in the USSR in 19[illegible].

2. Search for original models. This campaign started in 1930, with the government directive to accelerate the construction of the modern domestic DIP lathe.

3. Increase of the number of models produced. In 1941, the number of the mass-produced types of machine tools was around 450, but plans called for an increase of this number to 800 by 1942. The trend was always toward the design of large machines and machines for special purposes at the expense of smaller models and of all-purpose machines.

4. Increase of the average driving power. In connection with concentrating on the construction of large-size machines the average driving power was also increased from 5.3 horsepower in 1933 to 11 horsepower in 1937 per machine.

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Standardization and normalization. In conjunction with the extremely detailed and all-encompassing standardization of the Soviet machine-building industry, the machine-tool industry was also standardized. This standardization not only includes constantly recurring machine elements such as hand wheels, handles, levers, bearing, disks, measuring gauges, flanges, etc., but also whole machine parts, such as spindle head stocks, cutter heads, gear boxes, Norton gears, chucks, tool posts, etc. These parts developed in due time to standardized units, which could even be made interchangeable for machines of different types. In the course of this development, Soviet machine tools have gradually assumed the nature of "construction kit" assemblies. Indications are that within the near future individual plants will construct only certain individual parts, which will then be assembled at other State plants into single-purpose machines. Even today, some plants devote themselves exclusively to the manufacture of multiple-spindle cutter heads which are used in assembly-line machining. In the USSR, machines of this type, built of standardized parts according to the "construction kit" principle, are called "Aggregate Machines" (Aggregat-Bänke). This trend characterizes the present Soviet machine-tool industry. The reason for this trend, which is so different from that of the Western countries, is probably the lack of competition and the urgent necessity for mass production. This method of construction of machine tools with interchangeable parts has been officially prescribed, for the purpose of reducing the necessary stock of spare parts and construction costs to a minimum and for achieving a maximum degree of economy and production.

6. Automatization. Automatization to the utmost is being carried out for mass and series production. A few semiautomatic and fully automatic types had been developed before the war. The imperative wartime necessity of rapidly increasing production of armaments, with a great reduction in available manpower, gave rise to the previously mentioned assembly-line machining process (called "automatic lines" in Russian). These assembly lines consist of two rows of standardized machine tools, up to 50 in number, with the work running through between the two lines on a conveyor while it is machined simultaneously from all sides. The most recent fully automatic assembly lines also provide full mechanization not only of the machining processes but also of all auxiliary operations, such as placing the work in the machine, setting it up and fastening it, removing it after the process has been finished, and transferring it to the next machine.

These are the six main characteristics, but emphasis on special branches of industry and wartime necessity have led to the creation of a number of special types, sizes, control mechanisms, and other peculiarities of Soviet machine tools. Thus, for instance, the "Krasnyy Proletariy" Plant developed an original design of a heavy-duty multiple tool lathe for the machining of airplane crankshafts and camshafts, and heavy drilling machines for the production of gun barrels, while single-purpose multiple tool lathes for the machining of caterpillar track rollers were developed at the "Ordzhonikidze" Plant, and those for tank turrets at the "Stankokonstruktsiya" Plant.

In 1932, the value of the machine tools produced in the USSR was only approximately 2 percent of the total value of machinery produced; by 1937 this figure had risen to 3.2 percent.

Even at its inception, Soviet industrial planning was confronted with the task of specializing the existing plants and those under construction for sharply defined spheres of machine-tool building, while giving special consideration to the mass-production of certain models. The realization of this plan could not be started until 1939, since the carrying out of the project was delayed by initial difficulties, such as the rebuilding

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of the available machinery, the construction of new equipment, completion of designs, and the introduction of the new, unfamiliar production methods.

Even if the existing, badly obsolete plants had been thoroughly modernized they would still have been inadequate for accomplishing the increased production provided for in the Gosplan.

Probably the most difficult task for Soviet designers is the development of the special machine tools required by the rapidly growing automobile and tractor industry. The problem was finally solved by the creation of the above-mentioned 'construction kit" machines and finally by the introduction of assembly-line machining. In 1934, the "Stankokonstruktsiya" Plant built the first machine tools assembled from standardized parts, with technical advice being supplied by the Experimental Scientific Research Institute for Cutting Machine Tools and Tools (ENIMS) which is the supervisory and administrative authority of the plant.

Completely new designs have also been developed, in addition to, or, perhaps, in spite of, this far-reaching trend toward standardization. Their main feature is also the trend toward making most of the operation automatic.

Oddly enough, the Russians seem to pay little attention to the question of precision. The very voluminous periodical literature concerns itself with all kinds of problems, such as rigidity, vibrations, deformations of all kinds, etc., but the matter of precision is not considered of primary interest, either in literature, practice, or in the frequent conferences of experts. Schlesinger's Standards are considered fully adequate in most places. Thus, all the Soviet machine tools can hardly be called high-precision equipment, and the same goes for their gauges, but only as far as the most commonly used ones are concerned. It must be borne in mind that special measuring instruments of the highest precision are being made in the USSR for scientific and laboratory purposes. The "Kalibr" Plant in Moscow produces hundreds of types of measuring instruments and also makes automatic sorters for balls and rollers, apparatus for automatic control of hollow grinders, and a special apparatus for the fine polishing of measuring plates.

Finally, it should be pointed out that the Russians have done a remarkable amount of research work. It was carried out by the various research institutions in the field of machine-tool building, metalworking, and allied fields, mainly by the ENIMS Institute mentioned previously. The development of assembly-line machining by this institute has already been discussed.

It can be said, in conclusion, that Soviet machine-tool building has succeeded, despite its late start, in finding a trend which fits the industrial conditions of the country and has gone through a development which appears very promising.

The following list of machine-tool plants should not be considered complete:

Plant	Location	Products
"Lenin" Machine Tool Plant	Sterlitamak	Semiautomatic drilling machines with hydraulic feed, multispindle diamond drilling machines, deep drilling machines, vertical honing machines

Plant	Location	Products
"Lenin" Machine-Tool Plant	Odessa	Drilling machines, diamond drilling machines, honing machines
Machine Tool Plant	Moscow	Hydraulic broaching machines up to 10 tons capacity, surface grinding machines
"Kommunar" Plant	Lubny	Lathes, turret lathes
"Avtomatov" Plant	Leningrad	Automatic lathes for working from a wire spool
"Kirov" Machine-Tool Plant	Gomel	Slotting machines
"Proletariy" Machine Plant	Gomel	Centerless grinding machines
"Ilyich" Plant	Leningrad	Universal tool grinding machines, hollow grinders for ball races
"Stankonormal" Plant	Moscow	Cylinder drilling machines transportable
"Sergo Ordzhonikidze" Plant	Moscow	Semiautomatic machines, 4-spindle automatic bar lathes up to 90 mm dia, automatic transfer machines
Machine-Tool Plant	Odessa	Radial drilling machines
Internal Grinding Machine Plant		Universal thread-grinding machines
"Kalinin" Plant	Voronezh	Forge presses, hammers
Staro-Kramatorsk Machine Tool Plant	Kramatorsk	Presses, hammers, punch presses
"Krasnyy Proletariy" Plant	Moscow	Lathes, including DIP type, semiautomatic multiple tool lathes, wheel lathes
"Stankokonstruktsiya" Plant	Moscow	Involute milling machines, hydraulic broaching machines, special pipe-working machines, automatic transfer machines, drilling equipment

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Plant	Location	Products
"TsK Mashinostroyeniya" Plant	Kuybyshev	Semiautomatic short-thread milling machines and long-thread milling machines
"Kirov" Machinery Plant	Minsk	Vertical broaching machines
Grinding Machine Plant	Moscow	Surface grinding machines, semiautomatic grinding machines for ball-bearing races
Heavy Machine-Tool Plant	Kramatorsk	Roll-turning lathes, cutting-off lathes
"Gor'kiy" Machine-Tool Plant	Kiev	6-spindle semiautomatic lathes
"Kirov" Machine-Tool Plant	Tbilisi	Thread-cutting machines, pipe threading machines
"Frunze" Plant	Penza	Single-spindle automatic lathes
Machine-Tool Plant	Chkalov	Shaping machines
Machine-Tool Plant	Slavgorod	Forge presses
Machine-Tool Plant	Dmitrov	Milling machines
"Molotov" Plant	Kharkov	Vertical grinding machines for heavy roller bearings, hydraulic cylindrical grinding machines, radial drilling machines
"Sverdlov" Machine-Tool Plant	Leningrad	Parallel planing machines; electric copy milling machines, vertical lathes, semiautomatic profile copy milling machines, drilling machines (22 models)
"GZFS" Plant	Gor'kiy	Facing milling machines, 9-spindle horizontal milling machines, semiautomatic cylindrical milling machines, heavy-duty horizontal milling machines, thread milling machines without knee tools, horizontal copy milling machine
Machine-Tool Plant	Izhevsk	Lathes, turret lathes
Tool Plant	Chelyabinsk	Gauges, 0.002 graduations

Plant	Location	Produces
"MIZ" Tool Plant	Moscow	Calipers, snap gauges, broaches, gear wheel stamps, angle measuring instruments
Tool Plant	Leningrad	Lever-action measuring instruments, pneumatic measuring instruments, controlling equipment for gear cutting, special automatic measuring equipment
"Krasnyy Instrumentalist" Plant	Leningrad	Micrometers, vernier calipers, meters, measuring plates, angle measuring instruments
"Kalibr" Plant	Moscow	Measuring and controlling instruments of all types, plug gauges, ball-sorting machines, meters, inside measuring instruments, etc.
"Frezer" Plant	Moscow	Milling machines, cutting tools, broaches
"Pnevmatika" Plant	Leningrad	Pneumatic hand tools
Plant for Heavy Machine Tools	Novosibirsk	
Machine Tool Plant	Novocherkassk	
"Dzherzhinskiy" Plant	Yerevan	
"Kirov" Plant	Vitebsk	
"Komintern" Plant	Vitebsk	
"Zolts" Plant	Serpukhov	
"8 Let Oktyabr" Plant	Serpukhov	
Tool Plant	Voroshilov	
Abrasives Plant	Moscow	
Abrasives Plant	Tashkent	
Abrasives Plant	Chelyabinsk	
Abrasives Plant	Zlatoust	
"Vperod" Plant	Taganrog	
"16th Party Congress" Plant	Odessa	

Plant	Location
"Stankopatron" Plant	Murom
Gor'kiy Plant	Tomsk
Tool Plant	Minsk
"Stanok" Plant	Tbilisi
"Tsentrolit" Foundry and Machine Plant	Tbilisi
File Plant	Voroshilovgrad
File Plant	Miass