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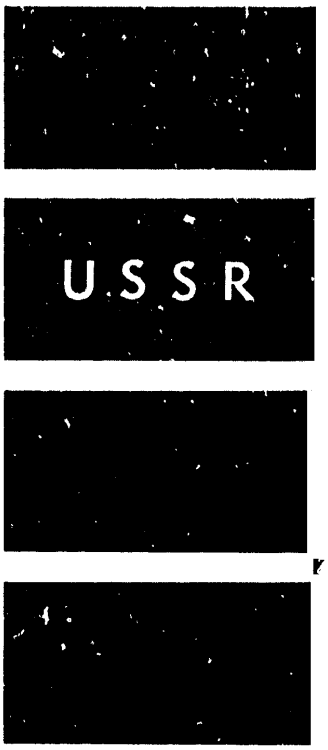

TRANSLATIONS ON USSR INDUSTRIAL AFFAIRS

(FOUO 7/79)

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TRANSLATIONS ON USSR INDUSTRIAL AFFAIRS

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CONTENTS PAGE

CONTENTS (Continued) Page

METALWORKING EQUIPMENT

MACHINE TOOL AND TOOL BUILDING PLANS FOR THE FOURTH YEAR OF THE TENTH FIVE-YEAR PLAN

Moscow STANKI I INSTRUMENT in Russian No 1, 1979 pp 1-2

[Unsigned article]

[Text] Our homeland has come to the year of 1979, the fourth year of the Tenth Five-Year Plan with prominent labor achievements. The Soviet people have successfully solved the historical problems stated by the 25th Congress of the CPSU. The resolutions of the November (1978) Plenum of the Central Committee of the CPSU, the speech at the plenary session by Secretary General of the Central Committee of the CPSU, Chairman of the Presidium of the Supreme Council of the USSR, Comrade L. I. Brezhnev are the program for the further struggle to improve the effectiveness of social production and operating quality.

During three years of the Tenth Five-Year Plan, the economic power of the country has increased significantly, the vital level of the people has been raised, and the position of the Soviet Union in the world economy has been improved. During this period the country has produced 1.4 times more industrial production than during the first three years of the preceding five-year plan. More than 700 new large-scale industrial enterprises have been put into operation, and almost one fourth of the fixed capital of our industry has been renewed.

Our industry is now producing more than all of the countries of Western Europe taken together, the population of which exceeds the population of the Soviet Union by one third.

On the basis of the mechanization and intensification of production, large-scale qualitative changes have taken place also in agriculture. The mean annual volume of gross production of agriculture was 125 billion rubles in three years of the current five-year plan, which exceeds by 1.5 times the indexes for the same period preceding the March (1965) Plenum of the Central Committee of the CPSU. The gross grain harvest in 1978, in spite of complicated weather conditions, was 235 million tons.

The July (1978) Plenum of the Central Committee of the Communist Party of the Soviet Union devoted to the problems of the future development of USSR agriculture was an even of enormous importance in the life of our country. The Plenum of the Central Committee of the CPSU adopted important resolutions, the implementation of which will permit acceleration of the attainment of the primary goal of the party--persistently to improve the standard of living of the workers of our country. The plenary session defined the ensurance of comprehensive dynamic development and significant improvement of the efficiency of all branches for further growth of the standard of living of the people as the principal goal of agriculture on the new level. This will permit the consumption of the most valuable food products to be increased, the demands of the Soviet people to be more completely met, and the material and cultural living conditions of the city and country to be brought closer together.

Soviet science is making a weighty contribution to the development of the national economy. Outstanding progress in the study and conquest of space is one of the confirmations of the powerful scientific and technical potential created in our country, the fruitful operation of the numerous creative collectives with respect to the entire front of modern science and engineering.

The record flight with respect to its 140 day duration of Soviet cosmonauts Vladimir Kovalenk and Aleksandr Ivanzhenkov concluded a phase of the saturated operations program of the orbital scientific research Salyut-6-Soyuz complex. The successful conclusion of the new space age convincingly demonstrated the high level of Soviet space engineering.

The active foreign policy activity of the Central Committee of the CPSU and the Soviet government in the past years of the five-year plan has been aimed at the preservation and strengthening of detente, the checking of the arms race, the strengthening of peace and socialism.

The new significant problems of economic and social development with respect to scale and complexity will be solved in the fourth year of the Tenth Five-Year Plan. The state plan for the economic and social development of the USSR and the state budget of the USSR for 1979 adopted by the Supreme Council of the USSR provide for the implementation of the set of large-scale measures aimed at solving the basic social-economic problems of the Tenth Five-Year Plan, the volume of industrial production will increase by more than 33 billion rubles as opposed to 28 billion rubles in 1978. The production-engineering potential of the machine industry created in the country, the presence in its branches of highly qualified industrial workers, specialists and scientists will permit the solution of more and more complex problems aimed at improving the efficiency of social production in the national economy. The basic productive capital of the machine building and metal working branches of industry will amount to 22.5 percent of the capital of all industry. In 1977, the proportion of the machine building and metal working production in the overall production volume of the industry reached 25.9 percent.

In 1976-1977, more than 5,400 models of new types of machines, equipment, apparatus and instruments were built. The indexes of the technical-economic level of production and quality of production output were improved.

In three years of the Tenth Five-Year Plan, about 9,000 nomenclatures of machines, equipment and instruments certified by the state symbol of quality were manufactured. In two quarters of the past year alone, the state symbol of quality was awarded to 1,254 new products of the machine building industry.

In 1979 on the whole with respect to machine building and metal working the plan calls for increasing the production output by 8.2 percent. Provision has been made for further changes in the structure of machine and equipment production.

The Central Committee of the CPSU and the USSR Council of Ministers adopted a resolution for the further development of machine building in 1978-1980 in 1978. This resolution of the Central Committee of the CPSU and the USSR Council of Ministers has defined the implementation of practical measures in accordance with the resolutions of the 25th Congress of the Party, the December (1977) and July (1978) Plenums of the Central Committee of the CPSU with respect to the further development of machine building, the improvement of the production structure, improvement of the technical level of the machines, equipment and instruments output for acceleration of technical reequipment and improvement of the efficiency of social production, the improvement of the quality of the production output in all branches of the national economy and more complete satisfaction of the demands of the population for national consumer goods as the most important goal of the machine building ministries, the associations subordinate to them, the enterprises, scientific research, planning and design, and technological organizations and also the party, trade union and komsomol organizations.

The resolution obligates the machine building ministries and to provide for the assimilation and production of machines, equipment, instruments and automation means in 1978-1980 with an output capacity no less than 1.5 to 2 times higher than the 1975 level, permitting acceleration of the operations with respect to complete mechanization and automation of the production processes in all branches of the national economy.

The ensurance of the machine building production volumes planned in the Tenth Five-Year Plan and improvement of the production efficiency in machine building depend to a great extent on the development rates of the machine tool and tool industry, the improvement of the quality of the machine tools, machines, tools and instruments produced.

The enterprises and organizations of the machine tool and tool industry have given special attention in the current five-year plan to the resolution of the large economic and scientific and engineering problems defined by the 25th Congress of the CPSU and the five-year plan for the national economy.

Among them are the following: expansion of the production of heavy and unique metal cutting machine tools, presses, high-precision machine tools; leading development of the production of metal working equipment with digital programmed control; an increase in the production output of automated lines for the machine building branches; accelerated development of casting machine building and the organization of complete deliveries of equipment for casting production; further expansion of the production of new types of metal cutting tools with the application of natural and synthetic diamonds and also other superhard materials.

In the past three years of the five-year plan, the rates of increase in production output of the machine tool and tool industry correspond to the level planned by the five-year plan: 9.9 percent in 1976, 10 percent in 1977, 8.7 percent (according to the preliminary data) in 1978. In 1979 the increase in commercial production output by 9.9 percent is to be ensured. Simultaneously provision has been made for further leading of the growth rates of the advanced types of products for satisfying the machine building requirements for highly efficient equipment and tools. All of the enterprises of the branch are faced with the problem of carrying out the planning assignments both with respect to the total volumes of production and established nomenclature and with respect to the delivery times.

The manufacture of the forging and pressing machines and equipment for casting production will receive leading development in the metal working equipment.

The production of heavy and unique, automated equipment and new types of metal cutting machine tools with program control has been increased significantly. In 1978, the output of special, specialized and unit machine tools increased by 23 percent by comparison with 1975, and in 1979 provision was made for a further increase in their output by comparison with 1978 by almost 9 percent; the output of the machine tools with digital program control in 1979 by comparison with 1975 must increase by 53 percent. New models of multitool machine tools are being created with devices for automatic changing of the tools, and their production will increase by more than 1.5 times in 1979 by comparison with the preceding year. It is necessary to accelerate the solution of the scientific and technical problems with respect to improving the technical level of metal working equipment with digital program control. This pertains primarily to the production of machine tools with small electronic program monitoring and control units. The operations with respect to the creation of the complexes of high-output metal working equipment controlled from a computer will receive further development.

The specialized plants and design organizations of the branch must provide for satisfaction of the planned assignments with respect to the creation and the production of new automated lines for large-series and mass production. The output of automated lines in 1978 increased by 35 percent by comparison with 1975; in 1979 it must increase another 9.5 percent.

The plan for three years of the five-year plan for the development of science and engineering has been fulfilled. In 1976 to 1978, more than 2,200 experimental models of new products have been manufactured, and more than 500 products of obsolete designs have been taken out of production. It is necessary to increase the proportion of the products of the higher quality category in the overall volume of production output; thus, with respect to metal cutting machine tools provision has been made for this index to be brought to 40 percent in 1979 as opposed to 29 percent in 1978. Special attention must be given to the execution of the plans for all around technical reequipment of the enterprises, the implementation of the plans for introducing advanced technology, mechanization and automation of the production processes provided for in the five-year plan. In the past three years of the Tenth Five-Year Plan the assignments with respect to the introduction of advanced technology throughout the branch have been completely satisfied. A great deal of new equipment has arrived at the enterprises, including high-precision machine tools with digital program control and special machine tools. As a result of the work that has been done in this area alone and the implementation of new measures, in 1979 it is proposed that the productivity of labor be increased by 3.5 percent and savings be obtained from lowering the cost of the production output by 35 million rubles. Further improvement of the growth rates of the productivity of labor and the effective use of the labor resources require broader introduction of the means of mechanization and automation of manual labor. In the near future the number of workers engaged in manual labor must be decreased by no less than 20 percent.

For the machine tool industry the greatest reserve for the growth of productivity of labor and reduction of production cost is the sparing, efficient utilization of material resources, primarily metal. Reducing the metal consumption of the products, decreasing the waste and increasing the use coefficient of the metal must be at the center of attention of the scientific research, planning and design process and production enterprises of the branch. It is necessary more broadly to introduce welding structural designs; by comparison with 1975, in 1979 the production of welded structural elements must increase by 26 percent. On the whole, throughout the brnach the consumption of ferrous metal rolled products must be reduced by no less than 4 percent.

The 1979 plan is an import link in the implementation of the resolutions of the 25th Congress of the CPSU and the assignments of the Tenth Five-Year Plan. The plan is the principal tool for realization of the economic and social policy of the party. It is necessary to provide for the fulfillment and overfulfillment of the planning assignments with minimum expenditures and high technical-economic indexes.

The industrial workers, engineering and technical workers and office workers of the machine tool building and tool industry, just as all Soviet people, widely engaging in socialist competition for early fulfillment of the plan

in 1979, will achieve new successes in the implementation of the resolutions of the 25th Congress of the CPSU and the Tenth Five-Year Plan.

10845
CSO:1821

METALWORKING EQUIPMENT

NEW MACHINE TOOLS AT THE EXPOSITION OF ACHIEVEMENTS OF THE NATIONAL ECONOMY OF THE USSR

Moscow STANKI I INSTRUMENT in Russian No 1, 1979 pp 35-36

[Article by I. R. Shvarts]

[Text] The exhibit on the work experience of the advanced collectives of the Ministry of Machine Tool Building and Instrument Industry--winners of socialist competition to improve production efficiency and production quality has opened in the machine building pavillion of the Exposition of Achievements of the National Economy of the USSR for September to December 1978.

For achievement of the highest results in the All-Union Socialist Competition, provision of stable indexes and execution of the plans and increased socialist obligations, the Minsk Production Association for Automatic Lines imeni 60th Anniversary of the Great October Revolution and the Gork'iy Machine Tool Building Production Association were awarded the Challenge Red Banners of the Central Committee of the CPSU, the USSR Council of Ministers, the All-Union Central Trade Union Council and the Central Committee of the All-Union Lenin Young Communist League, and they have been posted on the all-union board of honor.

The Minsk Production Association for Automatic Lines imeni 60th Anniversary of the Great October Revolution has specialized in the production of automatic lines for machining automobile and tractor parts, automatic lines for turning disk and flange type parts 200 to 500 mm in diameter, units and specialized machine tools (including the specialized and multiple tool machines with digital program control) and the circular saws.

Among the exhibits is a special model SM879 machine tool for drilling three center holes in turbine vanes with automated removal of the billet. The orientation of the billet is realized with respect to 5 degrees of freedom. The machine tool is part of the series of machine tools designed for the base surfaces of turbine vanes with optimal tolerance distribution over the curvilinear surface of the fin.

The specialized vertical multispindle model SM804 automatic machine tool is designed for drilling holes 8.5 mm in diameter in 40 parts simultaneously; the output capacity 1920 per hour. The horizontal two-way 20-spindle automatic model AM9586 drill is designed to drill holes 27.5 mm in diameter in wrist pins. It is equipped with a four position rotating drum on each face of which four parts can be machined simultaneously. The output capacity of the machine is 176 parts per hour.

The multinomenclature LM-700 automatic line is designed for complete machining (milling, drilling, thread cutting and boring) of flat parts such as cleats, plates, levers, prisms, and so on 200x500x500 mm. It includes four multitool machine tools with digital program control. The control is from an M6000 computer which stores and distributes the control programs with respect to the machine tools, undertakes dispatch control of the line mechanisms, optimization of the routing of the machining, determination of the order of loading the billets, monitoring the condition of the tool, and so on. The methods of clamping the machine parts and automatic orientation of them in the satellite permit the latter to be adjusted in 3 to 5 minutes. This makes frequent readjustment of the line possible, which is needed under individual and small series production conditions. The line is services by two operators. It replaces 20 all-purpose machine tools and increases the productivity of labor by fivefold.

The automated set of equipment for complete machining of the connecting rods for truck engines includes five automatic lines, 56 metal cutting machine tools (including those forming part of the lines), 4 automatic assembly units and 39 interoperation transport units. The output capacity of the complex is 390 units per hour, there are 21 service personnel. The introduction of this complex provisionally relieves 375 workers; the annual cost benefit from introducing it is 800,000 rubles.

Giving primary attention to the production of high-output equipment for the leading machine building branches, the association workers do not forget about national consumer goods. They are as responsive to the development and manufacture of these goods as to the basic product. Thus, in the production of door locks which have won great popularity among the population, the automatic layout stamping unit and the coining and molding semiautomatic stamping machine (the first of them made it possible to improve the productivity of labor by fivefold and the latter, by 2.5 times) and other efficient attachments are used.

In the association a great deal of attention has been given to introducing advanced equipment. The introduction of 52 machine tools with digital program control (including 4 multitool machines) has led to a 47 percent increase in productivity of labor, the production cycle has been shortened, and 65 machine tool operators have been relieved. In the machine tools produced by the association broad use is made of welded construction and plastic parts (there are about 270 different plastic parts), which promotes savings of ferrous and nonferrous metals.

In the various phases of the technological process broad use is made of the different attachments. Among them are the pneumatic clamping attachment for milling faces (improvement of productivity by 1.4 times), the attachment for milling inside trapazoidal threads on the screw thread cutting machine without channeling of the tool (a two to threefold increase in productivity), an attachment for grinding the periphery of flat cams in an Archimedes spiral, and so on. Their application not only increases the productivity of labor, but it also promotes improved utilization of the equipment and improvement of the labor conditions.

Among the high-output tools it is necessary to take note of the combined (passage and boring) hard alloy cutting tool, the auger deep drill, the preassembled worm milling cutter with 16 mm modulus (25 kg saving of high speed steel per cut); the set of preassembled end-type milling cutters typed with elbor; the knurling tools for applying numbers and divisions to dials and scales (improvement of productivity by tenfold, and utilization of the jig boring machines); a magnetic cube for monitoring the linear dimensions and precision of mutual placement of the parts on the control slab in three coordinate planes.

From year to year the quality of the association production has improved. Where in 1977 the production output with state symbol of quality amounted to only 8.3 percent, in 1978 it was 35 percent, and in 1980 it must increase to 61 percent. Every sixth worker in the association is an efficiency expert. 13 percent of the workers have a personal quality stamp, and 155 have been awarded the rank of "Excellent Quality Worker."

The Gork'iy Machine Tool Production Association is one of the largest enterprises of the machine tool building industry. It produces more than 40 percent of the milling machines and about 20 percent of the machine tools with digital program control out of the total number of machines producted by the branch.

The association has an automated production control system which controls the technological preparation of the production facilities, the operative control of basic production operations, the control of material and technical supply, quality control and bookkeeping.

The creation of a complex quality control system is aimed at improving the production quality and the productivity of labor in the planning, design, production, operation and maintenance phases of the machine tools. As a result of introducing this system, 90 percent of the production is accepted by the technical control division on first presentation. The annual cost benefit from improving the service life of the bracket milling machines exceeds 700,000 rubles, the proportion of the production certified by the state symbol of quality exceeds 30 percent of the total output.

Advanced technological processes are being actively introduced in the association. Thus, in the casting production the prefabricated core boxes made of normalized metal elements are used. In the machine shops, broad use is made of a cutting tool equipped with elbor-R and VOK-60 mineral ceramic, including end-type milling cutters, boring cutters and boring heads, combination turning tools and so on.

The central plant of the association is the Gork'iy Milling Machine Plant. It has assimilated the production of machine tools with digital program control as one of the first in the branch to do so. In the past 20 years it has gone from the first bracket milling machine with digital program control to modern milling and boring machines with a magazine holding up to 40 tools. The machine tools with digital program control manufactured during the Ninth Five-Year Plan made it possible to relieve 2,500 qualified machine tool operators at the plants of the Soviet Union. The production of the association has been exported to 70 countries of the world.

The series of milling machines developed by the association are distinguished by a high degree of standardization: in the bracket milling machines 0.87, and in the longitudinal milling machine 0.77.

The proportion of advanced equipment in the association is growing continuously. At the present time there are about 100 machine tools with digital program control in the association shops on which parts belonging to about 2,500 nomenclatures are machined.

The association has built the ASK-11 complex automated section designed for machining a broad nomenclature of housing parts to 631x631x630 mm in size under small-series production conditions. The basic unit of the section is the multitool model GF1880 machine tools with digital program control joined by a warehousing and transport system. The section is controlled from an M6000 computer. The section has made it possible to improve the productivity of labor by threefold, provisionally relieve 37 machine tool operators, and save more than 150 mm^2 of production area.

The association produces a number of machine tools for farm machine building. During the Ninth Five-Year Plan 436 specialized machine tools were designed, manufactured and delivered to the farm machinery building enterprises, improving the productivity of labor by 2 to 2.5 times. Their introduction has promoted accelerated assimilation of the mass production of the K-700, K-701, K-150 and T-130 tractors and the Kolos and Niza combines.

The association collective has more than 900 inventors and efficiency experts. During the Ninth Five-Year Plan 30 inventions and 3,789 efficiency expert proposals were introduced in the association with a cost benefit of 1,642,000 rubles. All of the collectives and workers of the association are working under the slogan of "In the battle to improve efficiency and operating quality no one must lag."

In 1977 12 of the association workers were awarded the rank of "Best Worker of the Ministry of Machine Tool Building and Tool Industry," 35 people received the authority to turn over production with their personal quality stamp. The work under personal programs provided up to 35 percent of the total increase in productivity of labor and made it possible to produce 252,000 rubles worth of production above the plan.

Seventy-eight percent of the engineering and technical workers are working under personal and collective creative plans. The criterion for evaluating the participating of an engineer in socialist competition is the cost benefit from introducing his creative plan. A social inspection of the efficiency of the utilization of raw materials, materials and fuel and energy resources is made annually in the association. In 1977 more than 60 percent of the workers participated in this inspection. The work experience of the collectives of the two machine tool building associations must become the property of the entire branch.

10845
CSO: 1821

METALWORKING EQUIPMENT

UDC 621.914.4

NEW MACHINE TOOLS DESCRIBED

Moscow STANKI I INSTRUMENT in Russian No 1, 1979 pp 33-35

[Unsigned article]

[Text] The model 6M610F1 longitudinal multioperation milling and boring machine with digital program control (see page 1 of the foldout), manufactured by the Minsk Machine Tool Plant imeni October Revolution, was designed for all around machining of parts by the methods of milling, drilling, and boring.

The milling and boring stock is of the slide block type with vertical spindle and rotating face head (the spindel of which has two operating ends) permits machining of parts in one setting from three sides, and when using a replaceable end type angular head, from five sides.

The structure of the digital positioning and rectangular control (the Razmer 2M-1104 type) provides for automatic displacement of the bench, the stock and the slide block to a previously given position and digital indication of the coordinates. There are three controllable coordinates (two simultaneously controllable); the discreteness is 0.01 mm.

The machine tool is equipped with a rigid portal with stationary crossmember. The moving assemblies are automatically clamped. In the main drive and in the feed drives DC motors are used. In the stock and slide block feed drives screw-nut rocking transmissions are used.

The vertical guides of the bench are hydrostatic; the horizontal guides are reinforced with antifriction faceplates. Provision is made for automated centralized lubrication of all the guides and gears; telescopic units are used to protect the guides. In the worm gear of the bench drive there is a device for selecting clearances required for climb milling.

The possible executions of the machine tool are as follows: with positional digital program control system (F2), with loop digital program control system (F3), with loop-positional control and automatic tool replacement in the vertical spindel (MF4); with additional horizontal milling stocks on pedestals; with different length of bench.

A tool holder with a set of mandrels, the end type milling angular head and bench for replacement of the heavy tool are delivered in addition to the basic set of attachments for an additional price.

Technical Specifications

Dimensions (width x length) of the operating surface of the bench, mm	1000x3150
Overal height of the machinable product (during milling), mm	800
Longest stroke of the bench, mm	350
Distance from the end of the vertical spindle to the operating surface of the bench, mm	70-970
Greatest transverse displacement of the vertical stock, mm	1900
Number of mechanically switchable steps in the spindle rpm	4
Spindle rpm limit, rpm	10-1250
Feed limits, mm/min:	
Of the bench	4-3000
Of the vertical stock	3-2400
Slide block of the vertical stock	3-2400
Speed of the fast stroke of the bench, the vertical stock and the slide block of the vertical stock, mm/min	4800
Greatest mass of machinable products, kg	8000
Overall dimensions of the machine tool (without the attachment replacement unit), mm	10,300x7,000x5,400
Weight with electrical equipment, tons	42

UDC 621.941.24

The model 1M63B screw-cutting lathe manufactured by the Ryazan' Machine Tool Plant is designed for various turning operations under the conditions of unit and small-series production. It is possible to use it for external turning, boring, drilling and also cutting of metric, inch and modular threads. The range of adjustment of the spindle rpm and the feed rpm permits maching of parts made of ferrous and nonferrous metals.

The model 1M63B machine tool has a number of peculiarities by comparison with the base model 1M63. They include increased rigidity and strength during cutting, expanded feed range and remote switching, and a gear box of improved design.

The precision of the geometric shape of the cylindrical shape of the surface of the models machined on attachment of them in the chuck is characterized by the following indexes: constancy of the diameter in the transverse cross-section within the limits of 8 microns, nonplaneness of the end surface no more than 15 microns; surface roughness R_a = 2.5 microns.

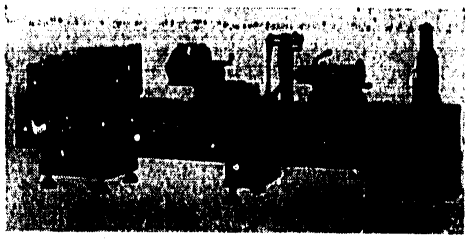

Figure 1. Model 1M63B Screw-Cutting Lathe

Technical Specifications

Greatest diameter of machinable product, mm:	
Above the bed	630
Above the slide	350
Greatest diameter of a bar passing through the hole in the spindle, mm	65
Greatest distance between centers, mm	2800
Rpm limits of the spindle (22 steps), rpm	10-1250
Feed limits (36 steps), mm/rev:	
Longitudinal	0.061-1.904; 0.03-0.952
Transverse	0.022-0.705; 0.011-0.352
Tool slide	0.019-0.595; 0.009-0.298
Power of the main electric motor, kilowatts	15
Overal dimensions of the machine tool (Length x width x height), mm	4950x1780x1455
Mass with electrical equipment, kg	5350

UDC 621.992.32

The model 5993U thread cutting lathe designed by the Odessa Special Design Office of Special Machine Tools and manufactured by the Chita Machine Tool Plant is designed for cutting cylindrical M12-M42 outside threads on previously machined and unmachined (rough) rod billets, skelps, bolts and other parts. A rotating thread cutting head serves as the tool.

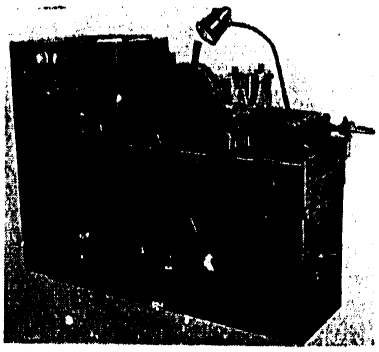

Figure 2. Model 5993U Thread-Cutting Machine Tool

The machine tool is manufactured in two executions: with manual (basic execution) and with electromechanical (delivered at additional cost) clamping of the product. The machine tool is distinguished by a simplified structural design. Its composition promotes convenience of inspection and repair; the control units are located so they are convenient for servicing.

Provision is made for cutting threads with third class precision (All-Union State Standard 16093-70); the surface roughness of the thread R_z = 20 microns.

Technical Specifications

Sizes of thread, mm:	
Diameter	12-42
Pitch	1.75-4.5
Greatest length	280
Greatest carriage stroke, mm	400
Diameter of the basing surface of the spindle, mm:	
Outside	900
Inside	70
Greatest diameter of installed product, mm	56
Rpm limits of the spindle (6 steps), rpm	45-250
Power of main electric motor, kilowatts	3
Overal dimensions of the machine tool (Length x width x height), mm	1585x910x1125
Weight, kg	1150

UDC 621.923.5-111.1-52:621.833

The model 5B703 high-precision semiautomatic vertical gear shaving machine designed by the Vitebsk Special Design Office of Gear Shaving Machine Tools and manufactured by the Vitebsk Machine Tool Plant imeni Komintern is designed for shaving cylindrical straight and spiral-toothed gears with outside engagement and also gears with barrel-shaped teeth by the method of longitudinal and diagonal feed. It can be used under conditions of small-series, series, and mass production.

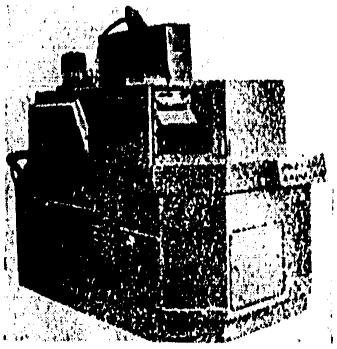

Figure 3. Model 5B703 Vertical Semiautomatic Gear Shaving Machine

This semiautomatic machine is equipped with a system for automatic fast play-free engagement with the machine gear. By individual order and for extra cost it is equipped with a special lifter for installing gears weighing up to 130 kg.

The structural characteristics of the device include the presence of the barrel shaping and radial feed mechanisms, the device for feeding the shaver to the machined gear, and spring-loaded attachment of the tool head. As a result of machining on the semiautomatic shaver, the precision of positioning the adjacent tooth profiles is increased by 30 to 50 percent, and the surface finish, by one class.

Technical Specifications

Diameter of installed product, mm	140-500
Modulus of machinable gears, mm	2-10
Greatest width of rim of machinable gear, mm:	
Without longitudinal modification of the tooth	150
With longitudinal modification of the tooth	140
Greatest dimensions of the tool, mm:	
Dividing diameter	280
Width	40
Rpm limits of the product (10 steps), rpm	50-400
Power of the main electric motor, kilowatts	3
Overall dimensions of the semiautomatic unit (length x width x height), mm	2260x1265x1930
Weight with electrical equipment and attachments, kg	4000

UDC 621.923.5-111.1-52.621.833

The 5A915 vertical semiautomatic gear honing machine designed by the Vitebsk Special Design Office for Gear Shaving Machine Tools and manufactured by the Vitebsk Machine Tool Plant imeni Komintern is designed for finishing

the teeth of heat treated cylindrical gears with external gearing with straight and spiral teeth and also with barrel-shaped teeth.

The semiautomatic unit operates by the method of knurling with an abrasive gear hone. By special order and at extra cost it can be equipped with a lift for installing and removing the machined parts weighing up to 150 kg. The unit is part of a new range of gear honing machine tools assimilated by the plant; it can be used to machine gears under the conditions of small-series and mass production in the various branches of machine building.

The kinematic circuit is made up of four independent chains: rotation of the product; axial feed of the hone; radial displacement of the carriage; rotation and fixing of the hone spindle. All of the feed movements (longitudinal and diagonal) are communicated to the hone which is located in the rear of the product and can turn by the angle of crossing.

The rotating guide unit is installed on the carriage. The latter is located on the horizontal guides of the bed and receives the preset movement from the screw of the radial displacement mechanism.

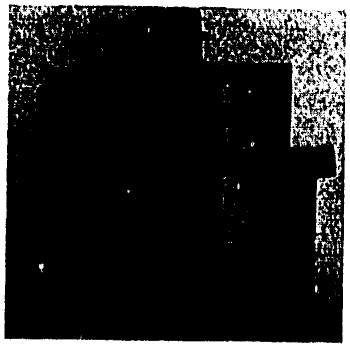

Figure 4. Model 5A915 Semiautomatic Vertical Gear Honing Machine

The spindle rpm of the product and the magnitude of the axial feed are adjusted by replaceable gears. The number of double strokes per gear honing cycle is set on the control panel. After switching on the "Cycle" switch, the entire gear honing process is automatic; on completion of machining, all of the mechanisms of the semiautomatic unit return to the initial position. The product is loaded and unloaded by the operator.

The machine provides for decreasing the roughness of the machines surfaces of the teeth by one to two classes and also removal of burrs and fine nicks.

Technical Specifications

Diameter of installable gears, mm	140-500
Greatest modulus of the honable gears, mm	12
Greatest length of tooth of the honable gears, mm:	
Without longitudinal modification of the tooth	150
With longitudinal modification of the tooth	140
Greatest load, kg:	
Radial	80
Peripheral	16
Rated sizes of the installable hone, mm:	
Diameter	250
Greatest width	40
Spindle rpm limits of the product (6 steps), rpm	160-500
Limits of axial feed of the hone (10 steps), mm/min	40-320
Power of the main electric motor, kilowatts	3, 7
Overall dimensions of the semiautomatic unit (length x width x height), mm	2260x1500x1930
Weight with electrical equipment and attachments, kg	4300

10845
CSO:1821

METALWORKING EQUIPMENT

UDC 621.73:658.2

GOALS OF FORGING AND PRESSING MACHINE BUILDING IN 1979

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 1, 1979 pp 2-4

[Article by Deputy Minister of Machine Tool Building and the Tool Industry of the USSR D. I. Polyakov]

[Text] Our great homeland has successfully completed the third year of the Tenth Five-Year Plan. In 1973, just as in preceding years, the Soviet people have enthusiastically worked on fulfilling the historic resolutions of the 25th Congress of the CPSU.

In the report to the 25th Congress of the party, the Secretary General of the Central Committee of the CPSU, Comrade L. I. Brezhnev noted the basic role which is played by machine building in the solution of economic, technical and social problems facing our society. This explains the enormous attention which the party and government are giving to machine building.

Accordingly, the Central Committee of the CPSU and the USSR Council of Ministers have adopted the resolution for "Further Development of Machine Building in 1978-1980."

In the resolution it was noted that during the Ninth Five-Year Plan, the machine building output increased by more than 1.6 times, new production facilities were put into operation, and many of the operating machine building enterprises have been expanded and rebuilt, the rates of creation and assimilation of advanced forms of machines, equipment and instruments have accelerated, which has promoted an increase in the productivity of labor and production efficiency in the branches of the national economy.

In addition, the achieved production volume and technical level of certain types of machines, equipment and instruments still do not fully correspond to the requirements of the future development of the national economy. In the machine building branches weak use is made of the production reserves, the shift index of the operation of equipment has slowly risen. In order to eliminate the existing deficiencies, the Central Committee of the CPSU and the USSR Council of Ministers have defined the most important goals with respect to improving the structure of production, improvement of the technical level of the machines, equipment and instruments for acceleration

of the technical reequipment and improvement of efficiency of social production, improvement of the quality of the production output in all branches of the national economy and more complete satisfaction of the needs of the population for national consumer goods.

The resolution provides for the specific assigns for the machine building ministries:

The assimilation in 1978-1985 of the production of machinery, equipment, instruments and automation means, the level of productivity of which is no less than 1.5 to 2 times higher than the productivity level for 1975, permitting acceleration of the operations with respect to complete mechanization and automation of the production processes in all branches of the national economy;

The development and organization of the production of new types of machinery in addition to the assignments established by the five-year plan;

Improvement of the proportion of the production of higher quality category in the production of the machine building commodities;

Implementation of measures to increase the service life before capital repairs of the basic types of machinery, equipment and instruments;

A reduction in weight of the manufactured machinery and equipment, and a decrease in metal losses during the production of them;

Reinforcement and expansion of the experimental bases of the scientific research, planning and design and of technological process organizations;

Expansion of the production of the complex technological process lines, units and installations with a high degree of factory and installation prefabrication and an increase in the volume of the patronage installation operations with respect to assembly and adjustment of them.

All the machine building enterprises and organizations must adopt measures for the implementation of the resolutions of the Central Committee of the CPSU and the USSR Council of Ministers in 1978 to 1980 on the further development of machine building.

In 1978, our country has taken a new, large step ahead as a result of the broad development of socialist competition and it has successfully fulfilled the plan of the third year of the Tenth Five-Year Plan.

The increment of industrial production in 1978 by comparison with 1977 was 5.0 percent, and the productivity of labor increased by 3.6 percent; three fourths of the increment of the industrial production was obtained as a result of improvement of the productivity of labor.

The enterprises and organizations of the Ministry of Machine Tool Building and the Tool Industry have also successfully dealt with the assignments of the third year of the Tenth Five-Year Plan.

The increase in commodity output in 1978 by comparison with 1977 was 9.7 percent, the productivity of labor increased by 7.3 percent, the machine tool output increased by 1.4 percent with respect to number and as a result of producing more complex machine tools, by 8.8 percent with respect to cost. The production of forging and pressing machines has increased by 3.7 percent with respect to quantity and by 9.4 percent with respect to cost. The production output of the especially short specialized and unit machine tools has been increased by 12.9 percent, machine tools with digital program control by 12.9 percent, automatic and semiautomatic lines for machine building and metal working by 13.3 percent, the equipment for casting production by 12 percent, the hydraulic drives and hydraulic automation by 13.8 percent.

In 1978 the industry of our country manufactured 55,500 units of forging and pressing equipment, 38,900 units of which valued at about 450 million rubles were manufactured in the enterprises of the Ministry of Machine Tool Building and Tool Industry.

At the specialized enterprises for the production of forging and pressing equipment, the structure and the types and sizes of the produced machinery have been improved significantly.

The production of high-output forging and pressing automatic machines, automated complexes, machines with programmed control, heavy and unique machinery, equipment for precision billets, casting machines for processing plastics, has been provided for at leading rates.

The basic areas of development of the national economy of the USSR in 1976 to 1980 adopted by the 25th Congress of the CPSU, along with an increase in production volume of the forging and pressing equipment for the most complete satisfaction of the requirements of industry provide for leading development of the production of automated equipment, complexes, including the use of automatic manipulators with program control (robots), automatic lines, equipment with program control, and equipment for obtaining precision billets, heavy and unique presses.

By 1980, the KPO production as a whole throughout the country will increase by 18.4 percent with respect to quantity in the five-year plan, and by 69 percent with respect to value. The KPM production in machine tool building and the tool industry must increase by 28 percent with respect to quantity and 71 percent with respect to cost. The production of heavy and unique machines must increase by 1.7 times with respect to volume in the five-year plan, and the production of special and specialized machines must double. The proportion of the automatic equipment in 1980 must be 28 to 30 percent (close to 17.5 percent in 1975), and the production of machines and complexes with program control must increase by more than four times.

Special attention has been given to the development of production of the most efficient equipment, in particular, automata for pressing and calibration of parts made of powdered metal materials and hard alloys.

Analysis shows that with respect to the majority of categories of advanced equipment the achieved mean annual growth rates of the production volumes will ensure the fulfillment of the control assignments of the five-year plan. However, with respect to the production of certain types of equipment there is a lag in connection with which the enterprises and organizations must take measures to support the further improvement of the structure of the KPO output.

The course adopted for the leading development of the production of automated equipment requires intensification of the operations with respect to specialization and concentration of the forging and stamping production of the consumers of the forging and pressing equipment, under the conditions of which the application of this equipment is most efficient.

In the developed measures with respect to improvement of the technical level of the forging and pressing equipment, the coefficients of the growth of productivity of the produced machines are defined as a result of an increase in the number of passes, improvement of the level of mechanization and automation, expansion of the nomenclature of the automated equipment. The indexes have been established with respect to the types of equipment as a result of improving the structural designs of the machines and the equipment of them with automation means. With respect to groups of machines on the levels of the type structure, basic areas have been defined for improvement of the structural designs, and the equipment with automation means has been extended to the equipment for sheet and volumetric stamping, the equipment for primary and secondary operations, the equipment using strip and ribbon material, bars, piece billets, powders and plastics as the initial materials.

In 1979, the national economic plan also provides for high growth rates of the industrial production output at the enterprises of the Ministry of Machine Tool Building and Tool Industry.

In 1979, by comparison with 1978 at the enterprises of the Ministry of Machine Tool Building and Tool Industry, provision has been made for increasing the commodity production volume by 9.9 percent. The manufacture of the equipment for billet production will increase at leading rates. Thus, with an increase in the machine tool production by 9.4 percent, the forging and pressing equipment output will increase by 14.3 percent, the process equipment for forging production, by 20 percent. In 1979 the KPO production in the country will reach 57,570 units with a total volume of 584 million rubles, including 40,570 units in the amount 514 million rubles produced by the enterprises of the Ministry of Machine Tool Building and the Tool Industry.

The new equipment plan in 1978 provides for a significant volume of operations aimed at the further improvement of the production structure: technical documentation will be developed for 81 new series KPM, 77 models of experimental industrial specimens of high-production, automated forging and pressing machines and automatic machines will be manufactured which keep the requirements of the higher quality category, and the production of the machines of the industrial series of 78 models will be assimilated, corresponding to the modern requirements of plastic flow technology which have been prepared for series production to satisfy the demands of the national economy; the obsolete designs of 24 models of KPM which have been replaced by modern machines will be taken out of production.

In order to carry out the assignments of the new equipment plans, the efforts of the enterprises and organizations will be directed at the following:

The assimilation of new models and types of machines to obtain precision billets, including crankshaft shears for precision cutting of new models, hydraulic automatic presses for finish blanking, presses for isothermal stamping, multiplunger presses for burrless stamping, forging rolls, equipment for cold and hot volumetric stamping, presses and automated machines for powder metallurgy, equipment for machining materials using impulse loads, and so on;

Assimilation of new models of automatic machines and machinery with automation means, including equipment complexes. Provision is made for the assimilation of sheet shears with automation means, sheet bending rolls, horizontal forging machines, frame type bihydraulic presses for sheet stamping, and single-stand presses, and so on. Out of the plans to be developed in 1979, 80 percent are plans for automatic machines, automation, equipment complexes and automation means;

The expansion of the operations with respect to the creation of machines and complexes with program control. Provision is made for the assimilation of the sheet bending presses of new types and sizes, pipe bending machines, machines with rotating flexible roll, radial reducing machines, sheet bending machines, and shears;

The performance of operations with respect to creating new types of complexes of manipulator presses, including the complexes based on hot stamping and coining presses, presses for cold extrusion, single crankshaft closed presses. The number of types and sizes of complexes based on the single crankshaft open presses has been expanded;

Assimilation of new models of heavy and unique machines, including presses: direct-action double crankshaft (longeron) presses with a force of 6,300 tons, the direct-action four-crankshaft press with 1,600 tons, hydraulic for isothermal stamping at 4,000 tons and so on.

Among the assimilated machines are the highly efficient machines with pulse and pulsating nature of application of the load: shears for pulsed cutting of cold metal, an electrohydro impulse press for sheet stamping, a machine for pulse briquetting of the filings, and a complex based on a hydraulic press with pulsating press.

In the plans for the new equipment provision is made for the assimilation of new types and models of machines and automated complexes for the leading branches of industry: automobile, tractor and farm machine building, aviation, power machine building, and so on. The created equipment is designed for various production conditions: mass, series, individual.

In 1979 the annual design organizations of the branch and the technological institutes of the country jointly with the plants and production associations are continuing their work to perform complexes of scientific research and planning and design work with respect to six most important programs approved by the GKNT of the USSR.

The solution of these problems touches on various branches of the national economy such as the creation of the complex for hot stamping of the drill billets up to 45 mm in diameter, a teledynamic-action casting machine with an injection volume of 125 cm^3, equipment for pressing products made of powder metal to 400 tons, an automatic line for sheet stamping of large automobile parts, equipment for pressing abrasive disks, automated equipment for the complete use of wood and a number of other pieces of equipment.

In the Ninth Five-Year Plan, the certification of forging and pressing equipment was started in the branch with respect to three quality categories, which offers the possibility of acceleration of the removal of obsolete designs from production and to increase the output of machinery providing for the modern technical level. In the last period, the proportion of machines with the symbol of quality increased with respect to number of models output from 1.8 percent in 1972 to 20 percent in 1978, the proportion and the overall volume of the commodity, from 1.6 percent to 23 percent. By the end of the five-year plan, the proportion of the production of higher quality category must be no less than 40 percent. It is necessary to note that achievements of the Voronezh Production Association of TMP which for the best results with respect to production output with the state symbol of quality was awarded the certificate of the All-Union Central Trade Union Council and the USSR Gosstandart.

Good results have been achieved by the Dnepropetropsk Production Association with respect to heavy press output and by the Khmel'nitskiy Plant KPO and a number of other enterprises.

In addition, at a number of the enterprises, the work on improving the equipment output and preparation of it for certification is being carried out satisfactorily and requires significant improvement.

The basic areas of development of the national economy in the Tenth Five-Year Plan provide for significant improvement in the quality of the equipment output, improvement of its technical level, output capacity and fail-safeness.

In connection with increasing the production in this five-year plan of more complex equipment with respect to design, the problems of improving the reliability and the service life are acquiring especially great significance.

It must be noted that in the Ninth Five-Year Plan the press construction enterprises and organizations have carried out significant work with respect to improving the reliability and duration of the KPM. In 1971-1975, the associations, plants and design offices carry out more than 300 measures as a result of which the reserve of forging and pressing machines was increased by 20 percent on the average.

During 1976 to 1980, the plan calls for increasing the KPM reserve by 20-50 percent by improving the structural designs of the machines, the process for manufacturing base and responsible machine parts and other measures.

The improvement of the technical levels, quality, reliability and service life of the KPO will be achieved by further introduction into production of the united widely standardized ranges of machines having a high degree of structural similarity both within the dimensional series of the range and between ranges, equipment of the production facility with standardized assemblies and means of mechanization and automation.

The broad assimilation of the standardized ranges of machines and assemblies is expanding the possibilities of improving the technological process for the application of specialized machine tools, group equipment with parts, the best use of the machine tools with digital program control, and a reduction in the labor consumption in production.

In 1979, the enterprises, the design organizations, the ENIKmash Institute and other subdivisions must give special attention to the operations with respect to the introduction of the most improved electric drive systems, electronic control units for the machines, complexes and automated lines based on large integrated circuits, programmed instruction units, computers and other reliable modern devices.

As before, special attention must be given to the expansion of the types and sizes, improvement of the layouts and quality of the hydraulic drive and hydraulic automation.

The enterprises of the VPO Soyuzgidravliki, the VNIIgidroprivod Institute must realize the necessary measures in 1979 to improve the quality, reliability, and service life of the hydraulic drives and hydraulic automation.

All of the enterprises and organizations of the branch must provide for the implementation of the plan measures and realize additional complexes of

operations ensuring an increase in the service life of the KPO before capital repairs.

The problem of reducing the mass of the manufactured machines is extremely urgent. The performed analysis of the weight parameters of the presses of certain plants in the branch has demonstrated that there are reserves for saving metal in the branch.

A decrease in mass of the forging and pressing machines is possible as a result of the following:

Simplification of the schematics of the instruments, reexamination of the structural design of the basic parts;

The application within broad limits of the alloy steel and high-strength cast iron, the introduction of the results of scientific research and experimental operations pertaining to the more precise definition of the procedure for calculating tables, slide blocks and the press crossmembers;

The conversion of the production of the products from ferrous metals to plastics, the conversion of the cast parts to welded parts, broader application of the bent and stamped profiles.

A significant reserve for reducing the mass of the pressing equipment is a reduction in mass and sizes of the kit products. In order to place the kit devices of increased overall dimensions on the beds, large sized recesses are required. This leads to additional increase in mass of the machines. This must be taken into account by the supplier enterprises of the Ministry of the Electrotechnical Industry and the Ministry of Instrument Making.

Machine building has an influence on the technical progress of all branches of the national economy. Therefore it is very important to reinforce the cooperation among them, widely attracting scientists and specialists of the various ministries to the creation and production of new equipment.

All of the associations and plants of the subbranch must analyze the weight parameters of the equipment produced, develop measures for further reduction of the mass of the forging and pressing equipment.

The production resolution and plans provide for the expansion of production and the delivery of kit equipment to the national economy. One of the means of realization of this goal is expansion of the nomenclature and output of the automated complexes and automatic lines. In the Tenth Five-Year Plan the output of the complexes is to be increased by eight times; in 1978 the actual production of this equipment exceeded the 1976 level by four times. An important initiative was manifested by the Voronezh Production Association for Heavy Mechanical Presses, the collective of which has concluded an agreement on creative cooperation with the AvtoZIL Moscow Association, planning to deliver 35 automated complexes to the Moscow workers.

In order to provide for the further development of the branch, provision is made for the creation of new plants for the production of forging and pressing equipment.

In answer to the concern of the party and the government for improving the standard of living of the people, the development of the branch, thousands of scientists, specialists, innovators, and advanced production workers are mobilizing all of their knowledge, the experience and capacity for solving the problems stated for machine building by the 25th Congress of the CPSU.

10845
CSO:1821

METALWORKING EQUIPMENT

SCIENTIFIC AND TECHNICAL PROGRESS IN THE MACHINE BUILDING INDUSTRY

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 pp 1-2

[Article by V. A. Pashevich, deputy chairman of the Central Board of the Scientific and Technical Society of the Machine Building Industry]

[Text] The year of 1978 was marked by new progress of the Soviet people in fulfilling the resolutions of the 25th Congress of the CPSU. The industry workers, widely engaging in socialist competition, have successfully fulfilled the plan of the third year of the Tenth Five-Year Plan.

A great deal of work with respect to the fastest use in the national economy of the achievements of science and engineering is being done by the scientific and technical societies of our country, among which a worthy role is played by the scientific and technical society of the machine building industry, including more than 3000 primary organizations and joining about 950,000 people in their ranks.

In performing the resolutions of the 7th Congress of the Scientific and Technical Society of the Machine Building Industry, the primary organizations and members of the society are concentrating their efforts on the solution of the most important problems in the field of machine building to improve the productivity of labor, accelerate the rates of complex mechanization and automation of production, the creation and introduction of equipment for theoretically new technological processes. In 3 years of the Tenth Five-Year Plan the Scientific and Technical Society of Machine Building developed more than 50,000 recommendations and proposals with respect to further improvement of engineering and technology, mechanization and automation of the machine building production, improvement of the quality of the products, the saving of metal, fuel, electric power and the improvement of the conditions of labor of the machine builders.

The most important area of activity of scientific and technical society is the introduction of the achievements of science and engineering into production. In his speech at the November (1978) Plenum of the Central Committee of the CPSU, Secretary General of the Central Committee of the CPSU, Chairman of the Presidium of the Supreme Council of the USSR, Comrade L. I. Brezhnev notes the leading role of machine building in increasing the productivity of labor and technical progress in all branches of the national economy.

The successful execution of the assignments with respect to new equipment is being promoted by the all-union, social inspection of the fulfillment of the plans for scientific research work and the utilization of the achievements of science and engineering in the national economy performed annually by the Central Board jointly with machine building industries and the Central Committee of the trade unions of machine building workers.

The last inspection was participated in by 1538 primary organizations and more than 535,000 members of the society. More than 400,000 proposals by the participants in the inspection were introduced into production. The greatest progress in the inspection was achieved by the primary organizations of the Poltava Artificial Diamond and Diamond Tool Plant imeni 50th Anniversary of the USSR, the Khar'kov Machine Tool Building Plant imeni S. V. Khosior, the Scientific and Production Association of the ENIMS Institute, the Ul'yanovo Main Special Design Office of Heavy and Milling Machine Tools, the ENIKmash Institute, the Troitskiy Machine Tool Building Plant and a number of other enterprises. The work experience of the Saratov Oblast Board of the Scientific and Technical Society of the Machine Building Industry with respect to assimilation of new equipment and above all, machine tools with digital program control is of interest. The measures performed in this area (raids to check the use of equipment, scientific and technical meetings, inspections for introduction of equipment, the courses for advanced training of specialists,and so on) have in the Tenth Five-Year Plan made it possible to introduce 148 machine tools with digital program control at the enterprises of the oblast and to increase their use coefficient.

The workers of the machine tool building and tool industry are faced with large goals with respect to the creation of the automated lines and high-output equipment for the mechanization and automation of forging and stamping production of billets. the creation of complex automated sections for machining of parts, the sections controlled from a computer and based on utilizing machine tools with digital program control. They are insuring a significant increase in the productivity of labor. There is also a great deal of work to be done with respect to the creation and assimilation of high-output tools made of synthetic diamonds, superhard polycrystalline materials, new types of solid alloys and high-speed steel with wear-resistant coatings; the creation and assimilation of the production of automated manipulators with program control; the development of new technological processes for manufacturing castings and the creation of casting equipment with a high degree of automation, and so on.

The State Plan for Economic and Social Development of the USSR in 1979 provides for leading development of machine building and metal working. On the whole, with respect to machine building and metal working, the increase in production in 1979 is 8.2%; the plan calls for assimilating the series production of about 800 new types of machine building products. The increase in productivity of the metal working equipment will be accompanied by further improvement of its structure. The output of forging

and pressing and casting equipment, special, specialized and unit machine tools, high-precision and multitool machine tools with digital program control and devices for automatic replacement of the tools will be increased, and the nomenclature of heavy and unique machine tools will be expanded.

The goal of the organizations of the scientific and technical societies of the enterprises and the organizations of machine tool building and tool industry is comprehensively to promote the solution of the problems stated before the branch. In 1978 the Central, Belorussian and Leningrad boards of the society jointly with the USSR Ministry of Machine Tool Industry held an All-Union, Scientific and Technical Conference with respect to the prospects for the development of a cutting tool and improvement of the efficiency of its use in machine building and also the first All-Union Congress of Foundry Workers. The recommendations and the decisions of these conferences are aimed at the introduction of the latest achievements of science and engineering into industry.

In machine building with the active participation of the organizations of the Scientific and Technical Society, a great deal of work is done to improve the technical level of the enterprises, for mechanization and automation of the production processes in the basic and auxiliary production facilities, improvement of the operating and introduction of new technological processes. In accordance with the plans for technical reequipment of the enterprises in the Tenth Five-Year Plan, measures are being realized which by 1980 will permit the mechanization of labor of more than 150,000 workers.

A great deal of work with respect to the reduction of manual labor is being performed by the organizations of the Scientific and Technical Society of the Machine Tool Industry of the Zaporozh'ye Oblast. The oblast workers have assumed obligations by the end of the Tenth Five-Year Plan to cut the proportion of manual labor at the industrial enterprises in half. The experience of the organizations of the Scientific and Technical Society of Chelyabinsk Oblast deserves attention where, as a result of the analysis and the realizations of the complex measures, the annual increase in level of mechanization of labor will exceed the mean throughout the country by approximately 2 times.

The most important areas of activity of the organizations of the Scientific and Technical Society of the Machine Building Industry are improvement of the technical level, quality and reliability of the produced machines, equipment and devices, an increase in their productivity, a reduction in the material capacity of the products, technical reequipment and reconstruction of the machine building enterprises. At the second plenary session of the Central Board of the Scientific and Technical Society of the Machine Building Industry, a great deal of work was planned for the organizations of the Sverdlovsk Oblast with respect to the technical reequipment and reconstruction of the machine building enterprises. The councils of the Scientific and Technical Society of the Machine Building Enterprises of the oblast regularly investigated the plans for the flow type process lines, sections

and new types of specialized equipment at their meetings; specific recommendations and resolutions are developed here, the social control of the course of reconstruction of the most important projects is realized, and organizational and technical assistance is rendered for installation, startup and adjustment operations and during the beginning of the operation and maintenance of the new equipment.

The organizations of the society are performing a significant amount of work with respect to saving metal. A reduction in the metal consumption of the manufactured machines and equipment, a decrease in the metal losses during their production constitute one of the most important assignments of the machine building industries defined by the resolution of the Central Committee of the CPSU and the USSR Council of Ministers "On Further Development of Machine Building in 1978-1980."

In 1978 the Presidium of the Central Board recommended for broad dissemination the initiative of the active members of the Scientific and Technical Society of the Machine Building Industry of Gor'kiy Automobile Plant with respect to the organization by the scientific and engineering-technical workers of a mass, creative search for the reserves to save metal and other materials, improve quality and reduce the labor consumption of the products. The group of scientists developed personal creative plans in 1978, the realization of which will insure savings of more than 35,000 tons of metal, the assimilation of 15 machine tools with digitral program control, the application of mathematical methods of experimental planning for the solution of technical problems, the introduction of new structural designs of the units and the advanced technological processes. All of this will significantly improve the quality of the products and it will lower the labor consumption of the manufacture of them.

The organizations of the Scientific and Technical Society of the Machine Building Industry are doing a great deal of work with respect to popularization of their achievements of science and engineering, improvement of the qualifications of the machine building workers. In 1978, more than 35,000 courses, seminars and schools with advanced experience were organized, about 140,000 lectures were given, and more than 40,000 members of the Scientific and Technical Society were in the scientific delegations at the advanced enterprises and in the institutes of the country. There are 492 public universities of technical progress and economic skills working in the primary organizations. It is necessary to give fixed attention to this area of activity in the future. It is very important that the seminars and the schools of advanced experience, the lectures and reports familiarize the workers, the engineering and technical workers and office workers with the latest achievements of science and engineering, and that they promote the application of the skills obtained in daily practical work.

With each year the number of primary organizations and members of the Scientific and Technical Society of the Machine Building Industry —

participants in the All-Union Socialist Competition -- is growing. Last year the Scientific and Technical Society of the Machine Building Industry was actively engaged in socialist competition of the labor collectives in honor of the first anniversary of the new constitution of the USSR to fulfill the assignments of 3 years of the Tenth Five-Year Plan by October 1978.

By the initiative of the primary organizations of Sverdlovsk, Khar'kov, Kiev and so on, many of the organizations of the Scientific and Technical Society of the Machine Building Industry adopted socialist obligations aimed at reducing the times and improving the quality of the scientific research and planning and design work and introduction of them into production ahead of schedule, by 7 October 1978. The developed creative plans were aimed at fulfillment of the assignments with respect to the mechanization and automation of the production processes, improvement of the quality of the production output, technical reequipment of the enterprises, efficient and economic consumption of metal, fuel and electric power, and improvement of the efficiency of labor and quality of work.

During the course of socialist competition for the worthy celebration of the first anniversary of the constitution of the USSR, many of the primary organizations of the Scientific and Technical Society have concentrated attention on the solution of the most important scientific and technical problems, and they have established control of the course of the fulfillment of the programs.

For successful fulfillment of the socialist obligations, the personal and collective creative plans adopted by the organizations of the Scientific and Technical Society of the Machine Building Industry in honor of the first anniversary of the constitution of the USSR the primary organizations of the VNIIgidroprivod Institute (Khar'kov), the Novosibirsk branch of the State Technological Design and Experimental Institute of Orgstankinprom, the Production Association for Heavy Presses (Dnepropetrovsk), the GosNIImash Institute imeni Academician A. A. Blagonravov (Moscow), and the Zaporozh'ye Instrument Plant imeni P. L. Voykov have been awarded the VSNTO certificates and the honorary certificates of the Central Board of the Scientific and Technical Society of Machine Building.

In order to improve the operating efficiency of the Scientific and Technical Society of the Machine Building Industry, further improvement of the mass-organizational work of the boards and primary organizations is required. The most important anzd urgent scientific and technical problems of machine building and metal working must be at the center of attention of the Scientific and Technical Society of Machine Building Industry. It is necessary to organize the daily control of the implementation of the adopted resolutions and recommendations and the introduction of them into production.

The Central Committee of the CPSU has stated important goals for the organizations of scientific and technical societies with respect to solving the basic problems of technical improvement and intensification of production,

the development and introduction of highly productive means of mechanization and automation, advanced technology, scientific organization of labor and production, the strengthening of the relation of science to production, the reduction of times and improvement of quality of the scientific research work, the effective application of the achievements of technical progress in the national economy.

The members of the Scientific and Technical Society of the Machine Building Industry are applying all of their skills and creative energy to carry out the stated goals.

10845
CSO: 1821

METALWORKING EQUIPMENT

UDC 621.9.02.015

MOSCOW TOOL PLANT IMPROVES THE QUALITY OF CUTTING TOOLS

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 p 3

[Article by A. M. Leyn]

[Text] The Moscow Tool Plant [MIZ] is an enterprise for small-series and individual production of metal cutting tools: gear-cutting, broaching, thread-cutting, pipe-cutting and sleeve-cutting tools. Several thousand agreements for delivering tools are concluded annually between the plant and the consumers. The sizes of the lots are small -- from several pieces to several tens of products.

For small-series and individual production, the insurance of a high level of technological discipline and stability of the technological process acquires special significance. It is the basis for high-quality production output. At the plant a complex plan has been developed, approved and is being realized for improving the tool quality in the Tenth Five-Year Plan. On the basis of this plan, the annual plans are being developed for improvement of production quality which is a component part of the plans for the organizational and technical measures and technical reequipment of the plant.

One of the basic quality indexes of a metal cutting tool is its precision. Therefore the means of insuring and checking accuracy are given special attention. The chief metrologist's service was organized in 1977 at the plant, including the laboratory of linear-angular measurement means and the control and measuring instruments laboratory. The fleet of available instruments is continuously being improved and filled out. Thus, in recent years, the instrument for complex monitoring of hob cutters under shop conditions, new laboratory instruments, projectors with different magnification and other instruments providing for the monitoring of a tool for the machining of high-precision gears have been assimilated and introduced.

The strength of a tool is a no less important quality index of it. In order to improve the strength of the produced tools, the following measures are taken: grinding of the tool with elbor, synthetic diamond and monocorundum discs, and so on (which insures high quality of the surface layer of the cutting surfaces of the tool); hard chrome plating of gear shapers (in order to reduce the friction on the gear surfaces of the tool and prevent

adhesion of the machined material); the introduction of cyanidation of hob cutters and shapers is planned.

In order to insure high quality of machining at the plant, 55 units of obsolete equipment were replaced, a number of high-precision machine tools were introduced, and a section of lathes with digital program control was organized. The introduction of the 3E70VF2 and 3E731 model machine tools for electrochemical diamond profile grinding has made it possible for the plant to increase the production of such high-precision tools as hard-alloy, thread-cutting casing tools of complex profile designed for working pipe in the oil industry. The replacement of the obsolete and modification of operating equipment, the introduction of special equipment, the application of especially high-precision machine tools have made it possible for the plant to improve the class of the produced tools: the proportion of the precision tools in the overall output exceeds 70%.

In the plan for improving the quality of production output, special attention has been given to the billeting and thermal operations which directly insure stability of the technological process. The acceptance monitoring of the rolled products made of high grade steel coming to the plant has been organized and is regularly applied. Stamping of the billets for shapers, thread cutting rolls and hob cutters (a number of sizes) has been introduced; in the near future stamping of automatic milling cutters and cams for thread cutting heads will be introduced. For quenching and tempering of high-speed steel tools, semiautomatic units are used with the application of a new quenching medium insuring high quality of heat treatment.

An important element in quality control is the systematic testing of the basic types of tools performed by the base laboratory of the plant. The operating indexes of the tested tool are compared with the normative data and the results of testing the tool from the leading foreign companies. The constant relations with the consumers also will permit monitoring of the operating indexes of the produced tool.

Work is being done at the plant to introduce a complex production quality control system based on the enterprise standards. The goals of the complex production quality control system at the plant, its composition, the characteristics of the standard, and the basic functions of the divisions and shops in the quality control system are defined. New enterprise standards have been developed which are aimed at improving the responsibility of each executive agent for the duties with which he is charged, the specific evaluation of the personal contribution to production and, on the whole, for the achievement of the basic goal -- improvement of operating efficiency and production quality.

In order to develop and introduce the complex system for production quality control, a working group has been set up at the plant. It includes the chief engineer of the plant, the chief technologist, the chief designer, the chief of the technical control division, the chief meteorologist, the

reliability laboratory chief, director of the standardization group, and the chiefs of the technical offices of the basic production shops.

The quality control plant is carried out in the production and control phase. The following technical documentation has been developed and introduced for this phase: instructions with respect to acceptance monitoring of the tool materials, a set of instructions with respect to procurement operations, the set of instructions for heat treatment, the standard technological process for the preparation and monitoring of precision gear cutting tools, broaches, hard-alloy thread-cutting chasing tools; the charts for controlling the equipment for technologic precision; the charts for checking the technological processes, and so on.

At the present time the plant has developed 28 enterprise standards with respect to the complex system of production quality control: in 1976 to 1977 the technical specifications for 18 types of tools were reexamined. In 1977-1978, the plant developed and introduced about 30 enterprise standards which are a component part of the complex quality control system.

As a rule, the preparation of the products for certification for the state symbol of quality is accompanied by reexamination of the structural design as a whole and more precise definition of the basic precision parameters, reexamination of the technological process and monitoring system in order to discover all possible re serves for improving quality. The most complex and important measures are included in the prospective plan for improving the quality of the basic products of the plant for the current five-year plan.

The above-enumerated measures have made it possible to certify 11 types of products for higher quality category, including the following: the hob cutters of precision class AA; the hob cutters in precision class A and B; the circular high-speed broaches with hard-alloy smoothing teeth; the faceted broaches for outside broaching; the gear cutting shapers for cylindrical wheels, the end-type hard alloy milling cutter; the threaded hard alloy chasing tools for cutting conical threads on pipe, and so on.

The production awarded the state symbol of quality accounts for 30% of the total volume of commercial production (including 60% with respect to the gear-cutting tool and 25% with respect to the broaching tool).

By the end of the Tenth Five-Year Plan, the proportion of production with the state symbol of quality is to be brought to 50%. This requires a great deal of intense work on the part of the entire plant collective with respect to carrying out the planned improvement in quality of the production output.

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IMPROVING PRODUCTION QUALITY IN THE ORSHANSKIY KRASNYY BORETS MACHINE TOOL PLANT

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 p 4

[Article by A. K. Miloserdnyy]

[Text] On the basis of many years of work experience to improve the production quality and culture of production, the Orshanskiy Krasnyy Borets Machine Tool Building Plant has created a scientifically substantiated production quality control system operating on various levels.

The developed system reflects the specific problems of all of the plant services, it raises the responsibility of each executive agent and director for work in his section and on the whole with respect to the plant; it requires constant improvement of the system for moral and material incentive, the development of specific technical and economic indexes with respect to improving the quality of the production output (the compilation of prospective, annual and quarter plans), the monitoring of the observation of the standards, the technical specifications and other normative-technical documentation.

The formation of the complex quality control system was preceded by a great deal of work. A study was made of the experience of the advanced enterprises of Saratov, Yaroslavl', Kremenchug, Minsk and L'vov, and recommendations were taken into account from the All-Union Scientific Research Institute of Standardization and the Belorussian Republican Administration of the USSR Gosstandart. A careful analysis was made of the quality problems at the plant itself. For this purpose, a coordinating and working group headed by chief engineer of the plant for the development and introduction of a complex production quality control system was created.

The plan developed by the coordination and working group jointly with the plant specialists provided for the creation and introduction at the plant of 51 enterprise standards. These standards constitute the organizational-technical and legal base for the quality control system introduced at the plant. The advantage of the enterprise standards over other forms of documents lies in their organic relation to the state standards.

At the present time there are 54 enterprise standards at the plant which encompass a broad class of quality control programs in the stages of development, production, operation and maintenance. In the development stage there are six enterprise standards with the help of which such problems as the prediction and development of initial data for improvement of the production output and new planning and design, manufacture and delivery of experimental models of the products are being solved.

The introduction of the indicated standards has made it possible to begin the assimilation of the new widely standardized range of surface grinding machines (15 models); 12 models were recommended for series production. With respect to degree of automation they are divided into the machine tools of all purpose design (the models 3Ye711V, 3Ye710V-1, 3Ye710A, 3Ye711V-1), the machine tools with programmed removal of the machining allowance and digital display (models 3Ye711VF1, 3Ye711AF1, 3Ye721VF1-1); the machine tools for shaped grinding equipped with a projector (model 3Ye711YeV-1); the machine tools with digital program control (models 3Ye711VF3-1, 3Ye721VF3-1).

The machine tools in the new group are with respect to technical level a qualitatively new level by comparison with the previously produced ones, and they are on the level of the best world models. The average level of standardization of the group is 77%.

The production quality control programs in the production stage encompass the entire production cycle for the manufacture and the improvement of the production output. They reflect the interaction of all of the production subdivisions and services of the plant. The plant attaches especially important significance to the solution (with the help of enterprise standards) of the following problems: 1) metrologic support which occupies one of the leading places in the quality control system, for all of the production activity is quantitatively and qualitatively estimated on the level of the measurements (this is the most significant when producing tools with high and especially high precision, when the measuring means with a scale division of 1, 0.5 and 0.2 microns are used in production); 2) insurance of rhythmicity of production; 3) organization of acceptance monitoring and quality control of the production output; 4) the procedure for certifying production and granting authority to the executive agents for self-monitoring; 5) the training of personnel.

The "evaluation of the quality of labor of the executive agents in the collectives, brigades, shifts, shops, divisions and other services of the plant is effectively influencing the quality indexes of the enterprise standards. The coefficient K_k of quality of defect-free labor has been introduced for determination of the moral and material incentives of each worker of the division, the shop with respect to the results of the operations for the month, the quarter and the year. The calculation is being realized on a computer.

In order to sum up the results of the work, the division of the automated production control system is preparing a tabulogram weekly. The final tabulogram for the month is being produced to reckon the prize for the shops, the sections, divisions and each worker separately. For K_k=1.0 to 0.85, an excellent rating is given, and the reckoned prize is paid in full. For K_k=0.85 to 0.75, the good rating is given, and the prize is also paid in full. For K_k=0.75 to 0.6, a satisfactory rating is given, and the reckoned prize is reduced by 25%; for K_k<0.6, a poor rating is given, and the reckoned prize is reduced by 50%.

The organization of the acceptance monitoring of the materials, the intermediate products and kit products delivered by cooperation with other enterprises is regulated by the enterprise standard introduced at the plant. Especially great significance is attached to the monitoring of pumps, hydraulic cylinders, the distributing hydraulic panels and electric motors. For checking and testing them at the plant, a section has been organized for acceptance monitoring equipped with the necessary test units and attachments. This monitoring establishes the fitness of the arriving products before their use in production. This offers the possibility not only of imposing claims for the quality of the products, but also jointly with the supplier, the development of measures aimed at improving the quality of the delivered production.

"Quality days" are being held at the plant. Twice a month at meetings in the shops and with the plant director there are discussions of the problems of improving production quality. Organization and technical measures aimed at improving the production quality and prevention of waste are confirmed, and the execution of the previously made decisions is controlled.

In addition, by the approved annual graph, control checks are made of the technical culture of the shops (the quality of machining the parts, observation of the technological discipline, the condition of the equipment, and so on) and also the control analysis of the machine tools and assemblies with checking of them for correspondence to the drawings, the technological process and technical specifications. With respect to production culture the plant commission, which includes the section chiefs, the leading specialists, the representatives of the social organizations and shops is making a weekly round of the work areas.

The operation of the plant subdivisions with respect to maintaining a stable high level of production quality is monitored by a permanent quality commission which at its meetings hears the reports of the service directors. It controls the course of the performance of the measures with respect to improvement of the quality, it analyzes the cases of violations by the executive agents of the principles of the production quality control system, it solves the problems of certification of the parts, assemblies and technological processes for the plant quality symbol.

As a result of introducing the complex production quality control system at the plant the losses from rejects have been decreased by 37% by comparison with 1975; more than 98% of the production is accepted on the first presentation.

The state certification of the machine tools produced by the plant sums up the multifaceted and intense work of the collective with respect to maintaining a high level of production quality. In 1967 the model 3711 especially high precision surface grinding machine produced by the plant was the first in the USSR among the metal cutting machine tools to be awarded the state symbol of quality.

Annually the plant overfulfills the planning assigns with respect to the output of higher category production. At the present time the state symbol of quality has been awarded to five models of machine tools.

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AUTOMATIC LINES FOR MASS AND LARGE-SERIES PRODUCTION

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 pp 5-6

[Article by L. S. Bron]

[Text] The performed analysis of the prospects for the development of advanced methods of obtaining billets at the enterprises of large-series and mass production demonstrated that before 1990 it is possible to expect a decrease in the proportion of the billets manufactured on metal-cutting equipment and other mechanical machining methods and an increase in the proportion of the billets manufactured by the high output methods on the forging and pressing and casting equipment (the volumetric stamping and cold extrusion, casting in a chill mold and the forms made of fast-hardening mixes, pressure casting, centrifugal casting, and so on).

In addition, the complication of the structural designs of the parts (in particular, housing parts) and improvement of the requirements on accuracy predetermine in the future the use of high-output metal cutting equipment for machining them.

In connection with what has been pointed out, the automatic machining lines and complexes of lines which insure multitool and multipositional machining of the billets and also transportation of them in the automatic cycle will remain the basic equipment for the machining of parts in large-series and mass production. In the Tenth Five-Year Plan the machine tool builders have designed, manufactured or are manufacturing new advanced automatic lines and complexes of lines.

At the institutes and organizations of the USSR Ministry of the Machine Tool Industry, scientific research work is being produced, the purpose of which is to improve the cyclograms of the automatic lines and methods of monitoring them [1], reduce the auxiliary time [2], develop and introduce improved methods of calculating the productivity of the automatic lines, the creation of new methods of reception and acceptance testing of the automatic lines [3].

The operations are being conducted with respect to the creation of more advanced automatic lines from the unit and specialized machine tool; new types of nonmetal cutting equipment, high-output tools, monitoring and measuring instruments and other machines and devices are being developed. Among them are the following: the rough and finish milling machines built into the automatic lines using the 50-60 kilowatt headstocks, broaching machines for broaching the keys under the covers of the crankshaft bearings of the cylinder blocks (machining precision no less than 0.024 mm, deviation from planeness -0.01 mm), boring machines for machining second class holes (cutting rate 100 to 400 m/min); a honing machine for obtaining first class holes; end-type milling cutters and boring bars equipped with nonresharpenable tips; drills for deep drilling; monitoring and measuring devices; the complexes of technical means based on the application of computer engineering for controlling the operation of the automatic lines.

The scientific and technical developments created by the institutes, organizations and plants of the Ministry of the Machine Tool Industry constitute the base for the manufacture in the next decade of technically improved high-output automatic lines and complexes of lines for machining housing parts, pistons, sleeves, bearings, shafts of stepped and complex configurations and other parts.

The automatic lines and complexes of lines are as a rule, special equipment designed for machining one or several such parts (in connection with which the schematics and compositions are developed for each automatic line and line complex, and the nomenclature of the built-in machines is selected); the annual output capacity of lines and complexes corresponds to the program for the production of finished products outfitted with these parts. Therefore, the forecasting of the technical level of the automatic lines and complexes of lines can be done approximately with respect to a number of quality indexes, the basic ones of which are the following: the number of units of equipment insuring the given output capacity, the occupied production area, the complexness of the machining (number of technological operations required for complete machining of the part), the machining precision, the technical-economic effectiveness, and so on [4 and 5].

Beginning with what has been discussed, it is possible to formulate the following basic areas for further improvement of the technical level of the automatic lines and complexes of lines for large series and mass production in the next decade.

Improvement of the output capacity of the automatic lines (one flow or one set of automatic line equipment) by 1990 by 1.7 to 2 times. This can be realized either by a direct increase in the output volume of the parts (in the case of production necessity) or a decrease in number of units of the builtin equipment and occupied production area (if an increase in output volume of the machined parts is not required).

An increase in the output capacity of the automatic lines can be achieved by the realization of the measures enumerated below.

1. A decrease in the machining tolerances as a result of the application of high-quality billets, the shapes and sizes of which approach to the maximum the analogous parameters of the finished parts.

2. The stabilization of the technological process as a result of a decrease in the scattering of the hardness of the cast and forged billets.

3. Forcing of the cutting conditions in the limiting operations by the application of advanced types of tools. The tool equipped with mineral ceramic nonresharpenable tips insures operation with given stability with cutting speeds of 300-500 m/min (milling) and 160-400 m/min (turning and boring). The tools equipped with mineral ceramic tips will permit significant improvement of the cutting conditions in the case of finish machining of the parts made of cast iron, alloyed steels and other materials that are difficult to machine. The grinding discs made of elbor provide for operation at cutting rates to 100-150 m/sec (finish grinding) and to 100 m/sec (power grinding).

4. The reduction of the auxiliary time by increasing the rates of transporting the billets to 30-50 m/min, the rates of fast idling of the power unit to 20 meters/min and a decrease in the time for fixing and locking the billets to 1-2 seconds.

5. Increasing the coefficient of general and technical use of the automatic lines as a result of reducing the idle time of the equipment (planned, accidental and for organizational reasons).

6. Improvement of the reliability of the equipment built into the automatic lines (power, transport and other standardized units; units of pneumatic, hydraulic and electrical equipment) and tool equipment.

7. The use of the complexes of technical means for control of the operating cycles of the automatic lines (with the possibility of recording, correcting and altering the program by application of key panels) equipped with timers (to monitor the cycle time and individual transitions of it) and different types of auxiliary information devices (including units to signal the location of failures and devices which record the operating time and idle time of the automatic line equipment). In the complex automatic lines it is expedient (in order to improve the operating level and increase the general use coefficient) to use a small computer to analyze the operation of the equipment.

8. The introduction at the manufacturing and customer plants of acceptance testing of the automatic lines with respect to the parameters of output capacity, reliability and machining precision (to determine the basic defects in the manufacture and assembly of the automatic lines and also the products making them up before acceptance in operation). The procedures developed at the ENIMS Institute [1 and 3] for acceptance testing of the

automatic lines based on processing (by computer) a large amount of statistical material on the actual operating reliability of the built-in equipment will permit (with a comparatively small test volume and time) guarantee of fail-safe operation of the automatic lines during operation with a high degree of probability.

Increasing the complexity of the machining on the automatic lines, that is, realization of all of the technological operations on the automatic lines and complexes of them from the basic operations (machine by cutting) to the auxiliary operations (washing, drying, assembly, monitoring, packing and so on). For this purpose it is necessary to solve a number of technical and organizational problems connected with the design, manufacture and series production of broad nomenclature of process equipment and standardized intermachine tool and interline transport systems (above all, for the parts of complex configuration).

The improvement of the machining precision on the automatic lines is caused by the growing requirements on the accuracy and stability of the basic sizes of machined parts. The possibilities of manufacturing billets with high precision parameters on the automatic lines (deviation from planeness 0.04-0.06 mm per 1000 mm of length; the machining of shafts and holes in classes 1 to 2; cutting of class 1 threads, and so on) are determined by the presence of finishing machines built into the automatic lines (boring, milling, honing, broaching, and so on) equipped with active monitoring instruments and devices for automatic adjustment of the tools. The improvement of the finishing equipment used on the automatic lines and the creation of new equipment which is more advanced is one of the main problems of specialized organizations and plants of the Ministry of the Machine Tool Industry.

The improvement of the precision of the parts machined on the automatic lines will be promoted by using small computers to organize the quality control. Several versions of the computers used for these purposes are possible: the application of computers for direct control of the monitoring and measuring instruments in the complex (including the small-purpose measuring machines for monitoring and sorting parts of complex configuration) with output of systematized information about the state and the necessity for adjusting the tool attachments of the finishing equipment, the application of small second-level computers to obtain information (about the dispersion of the dimensions and other factors insuring timely regulation or replacement of the tools to improve the machining precision on the positions of the automatic lines equipped with monitoring and measuring instruments, and so on.

The broad utilization of computers in the automatic line and line complex design stage for the solution of the following basic problems;

1. Storage, research and output on request by the designers of data on the automatic lines designed and manufactured in preceding years.

2. Calculation of the output capacity of the automatic lines and line complexes (including the selection of the optimal length of the line cycle with rigid coupling and the individual machine tools of the automatic lines with flexible coupling and cutting conditions in all operating positions based on the data on the equipment and tool reliability considering limited reliability of the initial data).

3. Calculation of the coordinates, compilation of specifications, the drawing of general types of spindle boxes and compilation of the programs for machining their housing parts [6].

4. Calculation and the planning and design of hydraulic and electrical systems of the automatic lines with simultaneous preparation of the programs for the introduction into the complexes of technical means which control the operating cycles.

5. The compilation of a data bank and calculation of the reliability of the mechanisms and assemblies of the automatic lines.

6. The planning and design of the technological processes -- the systems for machining standard parts on automatic lines for mass production.

The creation of the adjustable automatic lines of the following types: based on the small unit machine tools for machining housing parts of instruments, on the basis of the unit machine tools for machining the fittings; on the basis of unit machine tools for machining large body parts of buses, for machinery and other medium-series production products. By the adjustable automatic lines (in contrast to sections of machine tools with digital program control) we mean automatic lines designed for successive machining of a previously defined nomenclature of like parts.

In order to increase the production output and expand the nomenclature of parts machined on the adjustable automatic lines the following are necessary: 1) more precise determination of the efficienct areas of application of such automatic lines; 2) development of theoretical principles of planning and design; 3) the creation of a number of standard normalized assemblies (power benches with automatic switching of speeds, dividing and rotating benches with multiple spindle boxes, manipulators for loading and unloading the billets and so on); 4) the creation of automatic lines with satellite attachments (and without them) based on the tail spindle heads for machining small housing parts, and so on.

Types of automatic lines and machinable parts	Volume of manufacture, % Total	Including adjustable lines
For machining stepped shafts: up to 300 mm in diameter and 1000 mm long	10	3
For machining discs, flanges and gears	10	4
For machining the pistons and sleeves of automobile and tractor engines	4**	-
For machining parts of complex configuration (crankshafts and distribution shafts, connecting rods, cams, arms, and so on)	10	-
For machining housing parts	34*	4
For machining valves and wrist pins	4	-
For machining, monitoring and assembling parts and bearings as a whole	10**	-
For machining bolts and pins for automobile and tractor engines	3	-
For assembling the units and mechanisms of automobiles, tractors, electric motors, and so on	5	-
Other automatic lines	10	-

*Including 2% for machining small housing parts and the parts of instruments.
**There is a possibility of adjusting the automatic lines for machining analogous parts in a defined range of sizes.

In order to increase the production of automatic and automated assembly lines it is necessary to develop requirements on the products subject to automatic assembly and create high efficiency attachments for the assembly lines (devices for holding of bolts and nuts, torque wrenches, devices for quality control of threaded connections, and so on).

On the basis of studying the requirements for automatic lines, the following approximate enlarge structure of the types and sizes of automatic lines to be built in 1985 to 1990 is expected (see the table).

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AUTOMATIC LINES MADE UP OF UNIT MACHINE TOOLS

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[Article by N. M. Voronichev, M. A. Kunin]

[Text] In the next decade significant changes are expected in the structure of the Soviet machine tool fleet, the basic ones of which are enumerated below.

1. The demand for automatic lines, unit and specialized machine tools is increasing significantly in connection with an increase in the proportion of mass and large-series production.

2. The proportion of machine tools with digital program control is increasing sharply.

3. The proportion of machine tools for billeting and stripping operations (as a result of using improved billets) is diminishing, and the proportion of machine tools for finish operations is increasing respectively.

4. A significant amount of equipment is appearing for automation of assembly operations.

5. The proportion of machines for complex automation of technological processes in machine building will grow (for washing parts and assemblies, for metal coatings, heat treatment, conservation, testing for seal, and so on).

Great changes are expected in the organization of production control, which will have an influence on the structural design of the machine tools, machines and automatic lines. For example, for many types of equipment the possibility of efficient connection to the automated technological process control systems and automated shop control systems will become a mandatory requirement.

The structure of the fleet of unit machines and automatic lines made up of unit machines will change in the following way: 1) the proportion of automatic lines will increase sharply, for many of the parts which are today

machined on the unit machines (and all-purpose machine tools) will be advantageously machined on automatic lines with a growing output volume; 2) short automatic lines made up of multiposition unit machine tools will be created as a result of broad introduction of automatic devices for loading and unloading parts); 3) a significant number of adjustable automatic machine tools and automatic lines will appear for group machining, in particular, for machining large-scale parts; 4) automated lines for performing assembly operations will find broad application.

The further development of the structure and the structural designs of automatic lines and unit machine tools will be determined by the following basic factors: 1) the most complete satisfaction of the constantly growing requirements of consumers on the part of output capacity and machining precision; 2) an increase in complexity of the automatic lines by automation and mechanization of all of the technological process operations; 3) an increase in equipment reliability; 4) the use of the latest achievements of science and engineering when designing the equipment.

Expected changes in the technical specifications of unit machine tools and automatic lines made up of machine tools. As a result of improving the quality of casting, the machining tolerances must be decreased for cast iron and steel billets from 5-8 to 3-4 mm, and for aluminum billets, from 4-6 to 1-3 mm. The precision of locating the holes in the aluminum casting must be $\pm$ 015 mm. The technological process of machining must become more stable as a result of decreasing the dispersion of the hardness of the cast iron billets (from 25 to 10%) and improvement of their machinability. The possibility will appear for the machining of parts from new materials (graphite, high-strength aluminum, steel and alloys that are difficult to machine).

The output capacity of the automatic lines in one flow must increase by 1.6 times when machining aluminum parts and by 1.5-2 times when machining cast iron parts. This increase in output capacity will become possible as a result of increased reliability of the equipment, the application of advanced cutting tools (including those equipped with hard alloy with special coatings, hexalite, elbor and mineral ceramic) and improved drives for the power units and transport devices. The cutting additions in such operations as milling large surfaces, finish boring, drilling deep holes, will be improved.

The following changes are expected in the structural designs of the unit machine tools. The machine tools will become more complex, basically multipositional. No less than 50% of the machine tools will be equipped with devices for loading and unloading the parts, which will significantly increase the degree of their automation. Procedures will be developed for the application of an adaptive control system on individual operations during multispindle machining.

The feed drive of the power units will remain one of the two types; hydraulic or electromechanical. In connection with an increase in speed of the idle displacement by 30 to 100% the structural design of the drive of both types will change significantly. In the hydraulic drive broad use will be made of the standard solutions, and modular units will be used which will make it more reliable. The improvement of the reliability will also be broadened by special coatings of the internal cavities of the hydraulic cylinders, new types of seals and the application of oil, the viscosity of which will not change on variation of the temperature. The introduction of various systems of hydraulic storage units and multisectional pumps will permit a sharp decrease in the number of hydraulic stations and the area occupied by them.

The electromechanical drive will be made on the basis of the high-moment electric motors which will increase the speed and accuracy vibration of the drive. In the drive of both types provision will be made for devices for adaptive control.

From the other structural changes of the standardized units, the broad introduction of mounted guides, the coating of the guides of the moving units with special plastics to improve the service life, the creation of units of increased power and rigidity, and the introduction of the united centralized lubrication system with control of its arrival at all points are proposed.

Significant changes are expected in the structural design of the spindle assemblies. In connection with the application of advanced cutting tools, the machining conditions have become approximately twice as critical. This requires the application of new types of bearings. Globoid worm gears, undulating reduction gears, toothed and half-V belts are finding application in the main propulsion drives. Milling stocks with increase power are required.

In order to make use of adaptive control and automatic tool adjustment, standard spindle assemblies and mechanisms will be created. For the adjustable automatic lines and unit machine tools, structural designs will be created for fast-change spindle heads and boxes with telescopic spindles. The base parts of the unit machine tools will be basically made welded. In order to reduce their metal consumption, it is proposed that frame structural elements made of rigid elements combined with decorative elements be tested.

The systems for cooling and removing the shavings must be simplified by using centralized shop systems for feeding the cooling and lubricating liquids and removing the shavings.

The following changes are expected in the structural designs of the automatic lines. Depending on the required output capacity the automatice lines will be made single-flow or multiflow (several parallel flows).

All of the automatic lines will be complex. In addition to the metal-working equipment, machines will be built into them for intermediate assembly of parts, for monitoring the precision parameters, for removal of burrs, intermediate and final washing, heat treatment and other operations.

Along with the automatic lines designed for mass production, automatic lines will be manufactured for large-series and series production. Special machine tools with digitral program control will be built into such automatic lines. The proportion of lines for automated assembly of the mass production units will increase significantly in the overall output of automatic lines. The number of automatic lines made up of multipositional machine tools will increase.

Significant changes are expected in the structural designs of the transport systems for the automatic lines: the conveyors with ratchet mechanisms will disappear, for the rate of their displacement is limited; the stacker conveyers will become the most widespread; portal loaders will find application for parts (except housing parts); broad use will be made of the automatic lines with asynchronous transport and automatic lines with satellite attachments.

The number of different devices including those for active monitoring of exact dimensions will increase. Devices will appear for sorting the parts with respect to accuracy classes. The delivered set will include the devices for final monitoring of the finished parts. The pneumatic devices for monitoring the position of the parts in the operating positions and the devices for monitoring the condition of the cutting tool will find broad application.

For adjustment of the automatic lines (in the case of variation of the machined part) each section of the line must have a reserve position. In order to improve the conditions of labor and safety engineering all of the automatic lines will be protected by housings with electric blocking. They will be equipped with inspection sites and sites for replacing the tool, signal units, and if necessary, loaders and television sets. In order to improve the coefficient of technical utilization, the automatic lines will be equipped with devices for technical diagnosis of the condition of the machine tools, mechanisms and tools.

Expected changes in the control systems of the automatic lines and unit machine tools. The basic goal of the control systems remains reliable support of the operation of all of the mechanisms and tools in the given sequence with observation of the time of all elements of the cycle.

In addition, the modern requirements on the organization of operations in the shops and the operation of equipment has stated a qualitatively new problem for the control systems -- continuous tracing of the operation of equipment and timely communication about all of the malfunctions in order

to reduce to a minimum the time losses to eliminate organizational and technical causes of equipment idle time. It is proposed that the principle of directional control be maintained in the unit machine tools and automatic lines. As the sensors and servoelements (intermediate between the control system and the drive element), as a rule, contactless devices will be used (path sensors, the elements for manual feed of the instructions, the equipment for switching on the drive elements). The cycle control will be realized by a contactless logical device which has all of the necessary logical control functions and free programming, and it is coupled to the output elements.

All of the equipment participating in the overall technological process, depending on the nature of the production, will be combined into one or several systems in which the contactless logical device will do accounting, analysis and prediction of the operation of the equipment.

Expected requirements on the accuracy of manufacturing unit machine tools and automatic lines. A significant increase in accuracy of defining the requirements on the precision of manufacturing the defining parts of the automatic lines and unit machine tools is expected. This pertains especially to precision of the spindle assemblies of the milling machines and boring machines. For example, end-type and radial beating of the machine tool spindle for high speed and power milling must be no more than 0.002-0.003 mm. The requirements on the precision of manufacturing the gears, housing parts of the attachments and spindle assemblies will be increased significantly. As a result of the technical improvements enumerated above, an increase in output capacity of the unit machine tool by 1.5 times and the automatic lines by 1.5-2 times is expected in the next decade.

10845
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METALWORKING EQUIPMENT

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AUTOMATIC LINES FOR MACHINING PARTS OF THE SOLIDS OF ROTATION TYPE

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 pp 8-10

[Article by N. Ya. Anikeyev]

[Text] The parts of the type of solids of rotation amount to a significant proportion of the machine building production. They include the following: the bearing rings, the parts of automobile and tractor engines (valves, bolts, crankshaft and distribution shafts, sleeves, pistons, wrist pins, bushings), and so on. Significant growth of the productivity of the automobiles, tractors and other farm machines requires further improvement of the automatic lines which are the basic types of equipment for machine parts of the type of solids of rotation in mass and large-series production.

Considering the basic trends in the development of the processing of the parts of the type of solids of rotation, in the next 10 or 15 years the following are expected: an increase in the nomenclature and output volume of the products, an increase in their precision and mechanical strength, broad automation of production processes (both machining and finishing operations); broad introduction of automated production control systems using computers.

The introduction of advanced methods of forming parts of the type of solids of rotation (plastic flows in the cold state, centrifugal casting, and so on) will increase the precision of the billets and will give significant savings of metal as a result of obtaining billets, the shape of which is close to the shape of the finished products with precision obtained during turning. This will reduce the volume of turning and increase the proportion of equipment for abrasive machining.

Increasing the nomenclature and production volume of parts of the type of solids of rotation will permit the creation of automated lines which are convenient in operation with optimal output capacity and high load coefficient of the built-in equipment.

The automation of the production processes in machining and other technological operations will increase the proportion of automatic lines and special automatic machine tools in the overall fleet of equipment and will give rise to the necessity for the broad introduction of automated production control systems using a computer.

The basic areas of technical improvement of the automatic lines and equipment built into them are enumerated below.

The all around approach to the solution of the problem of obtaining cheap and high-quality production with minimum expenditures of material, labor and power.

Standardization of the parts of the type of solids of rotation by the technological principle and development of standard technological processes.

Automation of production processes not only in mass production but also in large-series and series production.

Improvement of the output capacity of the equipment and the quality of machining in order to satisfy the growing requirements of the consumers.

The introduction of new technological processes built on the latest achievements of science and engineering.

Improvement of the reliability of the automatic lines and machines, and an increase in their service life.

The introduction of logical and adaptive equipment control systems.

The introduction into the automatic lines of monitoring systems (for the operation of the equipment and the quality of machining) with control from a common computer; the use of a computer also to control the operation and maintenance of the automatic lines.

As a rule, the application in the automatic lines of equipment capable of machining parts in a defined size range.

Broad standardization and unitization of the developments, including for the creation of original automatic lines.

The maximum use in the automatic lines of the equipment produced by the enterprises of the USSR Ministry of the Machine Tool Industry (when developing the indicated equipment it is necessary to consider the fact that it is built into the automatic lines and the possibility of equipping with additional devices for automatic loading and unloading of parts).

Reduction of the labor consumption of the installation and adjustment operations and times for assimilation of capacity.

Improvement of the cost benefits from the automatic lines and special machine tools.

The purpose of automatic lines for the machining of parts of the type of solids of rotation, depending on the nature of production in the next decade, will not change significantly. The automatic lines for mass production must be adjusted to produce a defined product. The equipment and

transport media must permit the possibility of adjustment of the automatic lines to other like products within the limits of the defined size range.

The automatic lines for series production must be adjustable for output of several specific like products similar with respect to size and machine with respect to a united technological process. The creation of the multinomenclature automatic lines for series production of several parts (differing significantly with respect to size and technical specifications and machined by different technological processes) in the majority of cases is economically inexpedient, for the use coefficient of the equipment is decreased, the idle time as a result of complexity of adjustment is increased. It is also inexpedient to build automatic lines for assembling complexes made up of different numbers of parts of different configuration and purpose, for in this case there is significant idle time of the equipment both during the adjustment time and during operation.

The complexes of lines (the automatic line systems) must realize the complete technological cycle of machining parts and in the general case be made up of automatic lines for obtaining precision billets, for complete machining, for heat treatment, for control, conservation and packing.

In the automatic lines it is necessary to provide devices for monitoring the geometric parameters, the quality of the heat treatment and equipment for dressing products of shaft type. The automatic lines for assembling the products must be equipped with transport media realizing automatic feed of the kit elements from the holders and storage elements to the assembly machines.

If the equipment needed for automatic lines is not produced by the machine tool building plants, then when designing automatic lines it is necessary to provide the possibility of installing this equipment in the line (with respect to the initial data of the consumer) and corresponding transport devices. As a rule, the automatic lines must be standard (that is, created on the basis of the technically substantiated standard technological process), which permits us to make the transition to the modular construction of the automatic lines and built-in equipment; transport and loading media must also be standard. The modular construction of the automatic lines will reduce the time for planning, design, manufacture and the installation and adjustment operations, and it will also improve the conditions of assimilation, operation and maintenance of the automatic lines (including servicing of them and repair operations).

The output capacity of the automatic lines must be increased as a result of implementing the following measures: decreasing the tolerances on the billets, that is, obtaining parts with deviations with respect to geometric parameters of no more than 0.1-0.5 mm (on the billeting operations) and 0.05-0.1 mm (on the turning, milling, broaching and other operations with the application of cutting tools); improving the cutting conditions when machining with a cutting tool 1.5 to 2 times by the application of new types of tools (made of elbor, hexalite, mineral ceramic and tools

equipped with nonresharpenable tips); an increase in cutting speeds to 80-120 m/sec and transverse speeds to 15-25 mm/min when machining with an abrasive tool by the application of new types of abrasive discs and cooling and lubricating liquids, effective finishing of the operating surfaces of the abrasive tools.

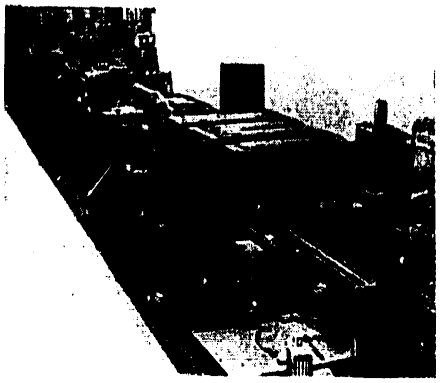

Figure 1. ME510LO automatic line for machining wrist pins

Figure 2. ME578LO automatic line for machining the fastening bolt of a bearing cover

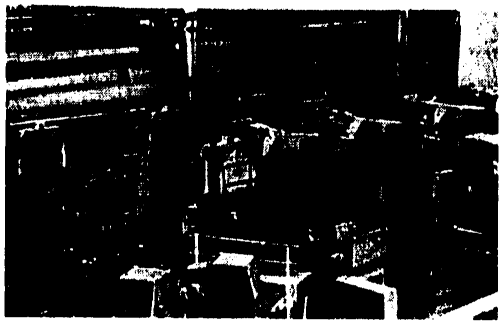

Figure 3. 6L439 automatic line of sleeve machining

The technical measures and the predicted volume of introduction of them before 1990 for the automatic lines for the production of bearing rings, bolts, valves, wrist pins (Table 1) and for automatic lines for the production of sleeves, pistons (Table 2) are presented in the tables.

Table 1

Technical measures	Predicted volume of introduction, %		
	1976-1980	1981-1985	1986-1990
Grinding with a cutting speed of, m/sec:			
35-50	98	35	10
50-80	2	60	40
80-120	-	5	50
Use of billets obtained by:			
Hot stamping with up to 5 mm allowance	85	25	20
Precision hot stamping, extrusion and rolling with a machining allowance to 2 mm	2	45	20
Precision cold stamping with a machining allowance to 1 mm	-	5	30
Cold extrusion and stamping with a machining allowance to 0.6 mm	13	25	30
Application of power grinding instead of turning	8	15	20
Coordinated grinding of several surfaces	15	20	25
Adaptive equipment control system	2	15	30
System for self-optimization of the machining cycles	-	5	25

Table 2

Technical measure	Predicted volume of introduction, % 1976-1980	1981-1985	1986-1990
Cutting conditions:			
Effective at the present time	100	30	20
Increased by 20%	-	70	20
Increased by 40%	-	-	60
The application of diamonds and diamond substitutes in finishing operations	10	20	25
Matched grinding of several surfaces	10	20	25
Adaptive equipment control system	-	15	50
System for self-optimization of machining cycles	-	10	40
Systems for logical control and the control of automatic lines from computers	-	10	50

The development and introduction of predicted technical improvements of automatic lines require the solution of serious scientific and technical problems connected with the creation of new types of equipment and the performance of experimental research work.

For further improvement of the grinding machines and improvement of their operating conditions, the modular principle of construction is necessary where the machine tool is made up of standardized modular units and in this case the modules for the same purpose but different execution are interchangeable. In order to insure high cutting speeds (80-120 m/sec for circular grinding machines and 80 m/sec for internal drilling machines) the following are needed: the introduction of powerful high-speed spindles on hydrostatic supports and on roller bearings; the application of automated or semiautomated balancing of the discs; the insurance of a stable grinding speed with disc wear; the creation and introduction of flat and half-feed belts capable of transmitting high power at high angular velocities. In order to improve the reliability of the machine tools, the broad application of screw type rolling pairs, powerful and high-momentum drives, rocking guides and hydrostatic guides, hydraulic and electrical equipment with long operating time per failure, is needed.

In order to reduce the auxiliary time it is necessary to increase the rates of fast displacements of the assemblies and the transport loading mechanisms, to dress the disc not with respect to the cycle but with respect to the actual necessity (determined by the machining pre-ision, the level of vibration, the increase in load, and so on).

The precision of the machining and the output capacity can be significantly increased by introducing the adaptive equipment control system and the system for self-optimization of the machining cycles. The self-optimization system is made up of high-precision, fast-acting instruments which not only control the quality and machining output capacity of the given time, but also they optimally change the cycle program (the transitions within the cycle, the machining conditions, the spindle rpm of the product, the oscillation frequency and the clamping down force of the product as a function of the transition).

For fast determination and elimination of failures in the equipment provision will be made for the systems for diagnosing the causes of failures.

Analogous problems must be solved for the creation of other special machine tools for machining parts of the solid of revolution type.

In order to insure efficient operation of the automation lines it is necessary to build standard transport means (storage elements, magazines, loaders, conveyers, and so on) having the possibility of adjustment (or universality) with a high degree of reliability.

The electrical industry must accelerate the assimilation and output within a wide range of the high-momentum electric motors (with built-in tacho-generators and electric brakes) and the control systems for them.

The demand for high-precision electric motors (with a vibration level of less than 1 micron), small devices for adjusting the rpm and the line electric motors, and the program control units (with stepping drive and digital display) and a number of other devices and systems is increasing. It is necessary to continue the operations with respect to improving the reliability of the electrical equipment and the apparatus used in the automatic lines and the automatic line control systems.

It is also necessary to provide for the completion of hydraulic equipment made from standard modules obtained by synchronized production by specialized plants. In order to improve the machining precision and the operating stability, the machine tools must be equipped with hydraulic drives which operate on hydraulic cylinders having an elastic baffle. The output capacity of the pumps must be adjustable.

The broad application of hydrostatic guides and hydrostatic spindle supports requires centralized output of specialized hydraulic stations. Specialized manufacture of the stations for centralized feed of the lubrication with automatic control and signalling in the case of emergency situations is also needed.

At the present time automatic lines are being manufactured for the parts of the automobile industry using technical improvements indicated above.

The ME510LO automatic lines (Fig 1) for machining wrist pins are made up of seven units of technological equipment connected by an automatic conveyer. On the automatic lines rough grinding of the outside surface, grinding of the ends and faces, semifinish and finish grinding of the outside surface, finishing of the outside surface, washing and drying are performed. The wrist pins are produced with a deviation no more than 7 microns with respect to outside diameter and 1 to 2 microns with respect to ovalness, conicalness and facing.

When manufacturing the fastening bolts for the bearing cover on the ME578LO automatic lines (Fig 2), the turning is replaced by power grinding. The 6L439 automatic line designed for broaching the hole and finish turning of the sleeves is illustrated in Fig 3. The final broaching of the sleeves is done by a tool made of elbore with a cutting speed of 420 m/min.

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EXHIBITION OF SWISS MACHINE TOOLS

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 pp 27-30

[Article by M. Yu. Yevstegneyev]

[Text] In October 1978 an exhibition of Swiss machine tools was held in the Sokol'nicheskiy Exhibition Complex under the motto "The Future of High Precision Machine Tools." About 70 companies, basically members of the "tools and measuring instruments" group of the association of Swiss machine tool builders showed metal cutting machines, equipment for machine without filing removal and also attachments, measuring machines and fittings in an area of 5000 m^2.

In accordance with the traditional area of development of machine tool building in Switzerland, the automated high-precision specialized equipment was predominant at the exhibit.

Lathe group of machine tools. In spite of a comparatively small (13) number of exhibits, all of the basic types of lathe equipment were presented which are characteristic of the Swiss industry, including two machine tools with digital program control (type CNC and HNC), five copying lathes with digital program control, and five automatic machines with cam control, and one all-purpose screw-cutting lathe.

For all of these machine tools, the tendency toward increased precision (especially by controlling the thermal deformations) with high output capacity is characteristic, insured by the application of the corresponding control systems and increasing the cutting speed and the idle speed.

The REV 60/8 lathe with digital program control (Habegger Company) is designed for the series of machining of parts. It is equipped with an 8-position revolving head and four transverse sides, one of which can be replaced by the copying attachment. Its distinguishing feature is the broad limits of operating feeds (5 to 8000 mm/min) and the extremely high idle speed (15 m/min for the revolving side and 22 m/min for transverse side) provided by the hydraulic drive under pressure in the hydraulic system of 40 kg-force/cm^2. The limits of the spindle speed are 52 to 4000 rpm.

The TAR-M/num65 machine tool with digital program control (Tarex Company) which is analogous with respect to purpose was of interest to the visitors from the point of view of the design of its turret-copying unit (Fig 1) combining the copying slides and the drive of the interchangeable 8-position revolving heads. Depending on the shape of the machine product, the turret coyping unit can be installed vertically or inclined.

The Tornos Company has presented the single-spindle MS-7, R-10 and RR-20 automatic machines and the AS-14 and BS-14 multispindle automatic machines.

The MS-7, R-10 and RR-20 automatic machines designed for machining bars 10, 12 and 20 mm in diameter, respectively, are equipped with a Barboy type loader made by the same company. These machine tools have spindles which are mounted on the bearings of the Micronic system and which are completely loaded from the tension of the drive belt. The tool module is delivered in five and six-cutter executions.

The 8-spindle automatic BS-14 insures the possibility of simultaneous machining of two parts as a result of the presence of the loading positions. The machine tools of this type are equipped with devices for stopping and locating the spindle in the oriented and in any position, which permits the use of special attachments, for example, a device for transverse drilling. The bed of the automatic machine is a welded structural element filled with concrete.

Both of the displayed multispindle automatic machines are equipped with a device for operative diagnosis. One is the 8-10 position circular switch with designation of the most typical failures installed on the bed of the machine tool and connected to a signal light. When necessary the operator can determine the location of the failure by a light that burns when the switch is rotated.

One of the most interesting exhibits at the exhibition was the 125-CNC lathe with digital program control (the Schaublin Company) (see Fig 2). In the main propulsion drive, an asynchronous motor, a belt variator and pneumatically controlled gear box were used. The feed drive is made up of a high-momentum motor with resolver and the screw-nut rocking transmission with preliminary tension. The rotation of the revolver head is realized by a pneumatic device, and the indexing, by toothed rims with end-type teeth. The widespread use of the pneumatic devices made it possible to do away with the hydraulic system.

The machine tool is equipped with the HNC type control system with built-in small computer and a memory of 8 K 16-bit words. The memory is made up of two parts designed for programming the movement of the slide and the auxiliary functions of the machine tool (the first part) and the geometric parameters of the parts (second part). Seventy-two subroutines have been introduced into the computer memory, including subroutines for rectilinear and curvilinear displacements, for multipath thread cutting, and so on.

Figure 1. Turret-copying unit of the TAR-M/num65 lathe made by the Tarex Company

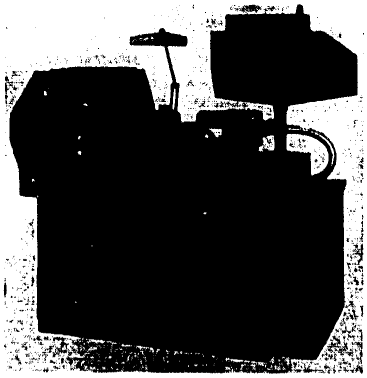

Figure 2. Model 125-CNC lathe built by the Schaublin Company

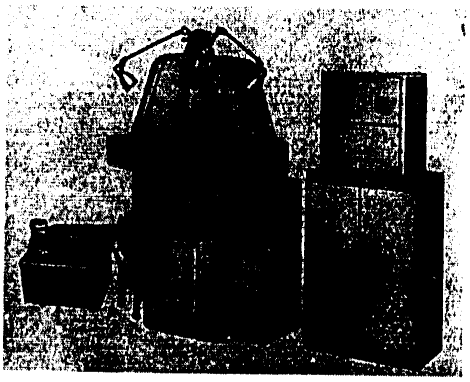

Figure 3. Model 125-SEV tool-grinding machine built by the Agaton Company

The operator will perform the coding by a drawing of the part using the reference code tables. It writes the code on a special form from which by the buttons and toggle switches located on the control panel it is entered in the computer memory. When necessary the program can be edited and written on a compact cassette. The program can be reproduced both from memory and from the cassette. The program size is usually no more than 50 frames.

Technical Specifications

Height of centers, mm	125
Greatest distance between centers, mm	350
No of positions of the revolving head	4
Rpm limits of the spindle (38 steps), rpm	48-3000
Speed, mm/min:	
with respect to Z-axis	0-1000
with respect to X-axis	0-500
Fast stroke speed, m/min:	
along the Z-axis	3
along the X-axis	2
Discreteness along the X and Z axes, microns	5
Power of the line drive, kilowatts	3
Mass, kg	1215

Machine tools for abrasive machining. Twenty machine tool building companies have presented more than 40 units of the equipment in this group. The basic trend for the grinding machines traced by the exhibition materials is a broad application of the means of active monitoring of dimensions during the cutting process and automation of the machining cycle.

The model 200 automatic machine built by the Voumard Company to grind cylindrical and conical holes and the end of the fuel jet housing is of great interest from this point of view. The automatic machine has two operating positions: in the first position the central hole and outside cone are ground, and in the second position, the end surface and the seal cone. Two jets are machined simultaneously. The machine tool is equipped with mechanisms for automatic compensation of the wear of the grinding disc.

The Agaton Company showed the model 125-SEV machine tool (see Fig 3) designed for manual electrochemical grinding of a hard-alloy soldering tool along the rear, front and auxiliary surfaces. The original design of the circular bench permits the cutting tools to be ground at any required angle, it permits grinding of the radial cutting edges; the roughness of the machined surface R_a=0.125 to 0.25 microns.

A high degree of automation distinguishes the surface grinding machine tool model MHPE 500 built by the Tripet Company with dimensions of the working area of 500x200 mm, which insures planeness of 2 microns. The machine tool

is equipped with a device for digital display of the displacement of the grinding stock and the transverse slides. The two-bit switches make it possible to select the vertical feed of the disc with reversing of the bench. The feed is from a stepping motor. The machine tool is equipped with rough (25 microns) and fine (1 micron) finish filters. The switches for reversing the bench fastened to magnets and interacting with the small, contactless terminal breakers are of significant interest.

The possibilities of the method of in-feed grinding are demonstrated by the specialized semi-automatic RS3-B2 with digital program control (the Ewag Company) for grinding multicutter tool (reamers, milling cutters, countersinks) and rotating tips. A distinguishing feature of the machine tool is the fact that the fine feed for in-cutting (discreteness 2.5 microns) is realized by a stepping motor. The automatic dividing attachment with the stepping motor provides for four or eight revolutions at odd angles with a precision of 54". The operating cycle is programmed using plugs and ten-position switches.

The broad utilization of electronic devices (the Studer, Hauser and Ewag Companies) for determining the contact time of the disc with the product with output to a pointer, a loudspeaker or headphones and which some of the disc speed has attracted attention.

Drilling-milling-boring group of machine tools. It is possible to note the appearance of especially thin multitool machine tools with digital program control based on the precision all-purpose equipment.

An interesting design for the multitool SIP 800/65 machine tool with vertical spindle was presented by the SIP Company. The basis for the design is a closed rigid frame which does not have visible deformations under high cutting forces. For displacements with respect to three axes there are roller guides with preliminary tension. The spindle stock is cast in the same unit with the gearbox and guides, which guarantees high precision of the location of the spindle axis. The latter is turned at a frequency of 10 to 3000 rpm by a 10 kilowatt electric motor with a speed variator and a 3-position selector. The stroke of the bench (the X-coordinate) is 1200 mm, the stroke of the stock (the Y-coordinate) is 900 mm, the stroke of the moving cross member (the Z-coordinate) is 950 mm. The rate of coordinate displacements is 0-6 m/min with a feed drive motor power of 1.5 kilowatts. The spindle feed (in the horizontal plane) is 0.001-6 mm/rev. The control system provides for correction of 15 values of the radius and 40 values of the tool length.

The displacement drive along the Z-axis (see Fig 4) is of interest, in which the movement of the ends of the cross piece is matched by means of linear inductosyns, which during motion insures parallelness of the cross member with respect to the plane of the bench. According to the company data, the mean square deviation of the errors on installation, just as the

errors caused by blocking and reversing is no more than 1,5 microns. The machine tool weights 31 tons.

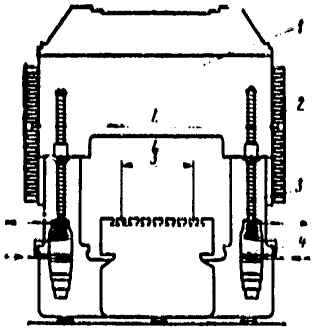

Figure 4. Control system for the moving cross bar of the SIP 800/65 machine tool built by the SIP Company: 1 -- cross bar; 2 -- linear inductosyn; 3-- screw-nut rocking transmission; 4 -- electric motor

The multitool HM4MCT machine tool built by the Oerlikon-Buhrle Company is equipped with an original system for replacing tools in which the used tool is installed in the nearest free recess; new information is then entered in the computer memory on the position of the tool. The operation of finishing the cone of the tool by rotating brushes is included in the tool replacement cycle.

An interesting example of a machine tool which combines high precision with the advantages of program control is the DIXIF330EV boring machine of the DIXI Company (see Fig 5). It has a two-column design with high rigidity and is equipped with an optical system for reckoning the displacements with respect to all of the linear coordinates (discreteness 0.001 mm) and also turning the table (discreteness 1"). This insures a precision of the linear displacements of $\pm$0.002 mm, and angular displacements of $\pm$2". The possibility of rotation around the C-axis (by means of a special auxiliary vertical bench) will permit the product to be machined in one setting along all planes and in practice at any angle in space.

The application of the digital program control system of the CN-DIXI-Vidimatic type made it possible significantly to reduce the machine time, first of all, of the products with high complexity. The positioning takes place in two steps: initially, the rough setting using inductive pickups (precision $\pm$0,015 mm), then exact positioning (precision $\pm$0,001 mm) using the line measure (scale) installed on the bench, the reading of the data from which is accomplished by the Vidicon type television camera. The scales are made of heat-stabilized, chome-plated steeel.

The spindle drive is 8 kilowatts. The speed limits are 8 to 1600 rpm. The spindle has oriented halt with precision of 10°. The feed along the X, Y and Z axes is continuous (hydraulic drive) within the limits of 3-990 mm/min.

The machine tools of this type can be equipped with a device for automatic tool replacement with a capacity of up to 144 tools and a system for loop program control which converts them to precision multitool machine tools.

The trend in equipping the all-purpose milling machines with simplified control systems is traced well on the WF type machine tools of the Mikron Company. These machine tools have either only a reading system (the Heidenhain Company) based on the glass line grids and the digital coordinate display (storing them is possible) or a simplified system with digital program control with programming of the rectilinear circuits. In the latter case the program is realized manually by a keyboard. The given values of the coordinates are often lighted on a display. The editing of the program and the connection of the recording units on magnetic tape with simultaneous printing out of the program is possible. The programming is simple and does not require special programmer's qualifications of the operator.

The Polimatic 100 NC2 drilling-milling-boring machine (the Fehlmann Company) is equipped with this type of system. The coordinate bench drive contains a stepping engine and a screw-nut ball pair. The control of the operating displacement of the spindle is cyclic (standard cycles are programmed). The structure of the digital program control of the machine tool equipped with small computer will permit realization of the loop machining as a result of the presence of linear and circular interpolators. The program put together in accordance with the outline of the part is recorded on a form as the codes for the process instructions and geometric data. The operator inputs the program directly at the work area. The machining program can be repeated many times. When storage is required, it is recorded on a magnetic tape.

The all-purpose WF3-CNC milling machine built by the Mikron Company is designed for milling complex curvilinear outlines; the dimensions of the working zone are xXyXz-500X500X320 mm. The stepping motors insure an operating feed within the limits of 1-400 mm/min and a fast stroke speed of 1.2 m/min; the speed limits of the spindle are 50-2240 rpm (12 steps). The control system of the CNC type model FPK-8 (built by the Andron gmbh Company) of this machine tool is executed in the form of an operator panel with display insuring the possibility of manual programming, checking and editing of the programs. The program carrier is in the form of magnetic discs which, in the opinion of the company, insures the best preservation of the program with high information density. The ready-access memory for the system is 8 K.

Machine tools of the gear grinding group. The general direction of development and improvement of the Swiss gear grinding machines consists in improving the precision and output capacity, expanding the technological possibilities and the application of the electronic control systems. At the exposition five companies presented 12 equipment units for gear grinding and monitoring of the gears; some of the machine tools were shown for the first time.

Attention was attracted by the RKZ 400 machine tool built by the Reishauer Company designed to grind rings up to 400 mm in diameter and with a modulus to 10 mm. The belt-drive rolling mechanism is combined in it with electronic control of the adjustment and the machining cycle. The vertical displacement of the carriage of the grinding disc is realized along the rolling guides from a hydraulic cylinder. The machine tool is quickly adjusted and, according to the company data, provides grinding precision which is a degree higher than usual on this type of machine tool.

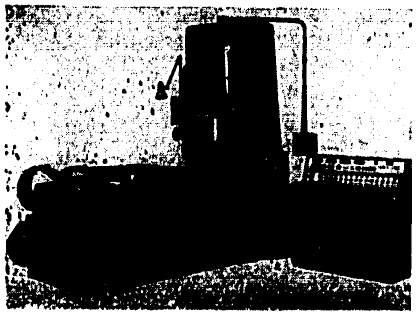

Figure 5. A DIXI F330EV boring machine built by the DIXI Company

The A33 machine tool built by the Mikron Company is an example of a fast-adjustable gear grinding machine which is especially advantageous under the conditions of small-series production. It is designed to machine wheels up to 80 mm in diameter with maximum modulus to 2 mm, and it has plugboard control of the machining conditions and also a swivel head which is automatically switchable to different numbers of teeth.

The loaders models W31, W38 and W25 built by the Wahli Company for gear grinding machine tools are prospective in the opinion of the specialists. With a capacity of 20,000 to 200,000 pieces, the loading time is 0.3 to 1.5 seconds.

The electrophysicochemical equipment group was represented at the exposition by three machine tools built by the AGIE Company. The copying broaching machines models EMS 2.20 and EMS 3.30 insure machining of the holes and cavities. The structural design of the oscillating head will permit this machining also at an angle. Provision is made for remote control of the frequency of the planetary movement of the electrode in the tracking regime and step variation of the amplitude of the output voltage. The display unit for the stability of the process installed on the control panel permits the operator to optimize the machine conditions. High-momentum electric motors are used in the feed servodrives.

The model DEM-250 electroerosion slotting machine is equipped with a stationary bracket with devices that provide for varying the slope angle of the wire and the magnitude of the bracket opening. The digital program control system model Agimerique CNC provides for five-coordinate control (displacement of the bench with respect to the X and Y axes and displacement of the vertical guide of the wire with respect to the X, Y and Z axes) and automatic correction of the program as a function of the actual position of the part on the bench of the machine tool.

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CSO: 1821

METALWORKING EQUIPMENT

UDC 621.9.06-529

EXPERIENCE IN THE INTRODUCTION OF MACHINE TOOLS WITH DIGITAL PROGRAM CONTROL

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 p 30

[Article by V. D. Nelyubin, F. I. Fedorov]

[Text] At the enterprise there are 160 model PFP-5s, FP-7, FP-9, FP-17, 6N13GN1, 1K62PU, ATPr2m12s machine tools with digital program control in operation. The five-coordinate FP-14 m1 milling machine, the MA-655A multitool machine, the FP-17MN three-coordinate milling machine tools (with built-in N33 interpolator) and the KFP-250A three-coordinate milling machine tool are in the assimilation stage. Parts with more than 1800 nomenclatures are being machined on machine tools with digital program control.

The installation, adjustment and acceptance of machine tools with digital program control are being carried out by the chief power engineer services which include specialized laboratories (hydraulic and electrotechnical). The acceptance of the machine tool by the shop is formalized by a document. Further servicing and repair of it are the business of the shop mechanic services which include the electronics groups.

Specialized sections of machine tools with digital program control for machining standard parts have been set up in the mechanical shops. In addition, the machine tools are grouped with respect to type of machine materials (steel, nonferrous metals and alloys). The machine tools of the lathe group (models 1K62PU and ATPr2m12s) have also been grouped together. This organization of the sections will make it possible to introduce a multiple machine tool servicing. At the present time 57 of the operators are servicing 76 machine tools with digital program control for two-shift operation.

The following procedure has been established for the transfer of the machining of parts to machine tools with digital program control. When starting up a product for production, the complex brigades including the shop technologists, the specialists in the chief technologist's division

and the program control division inspect the drawings and make a list of parts to be machined on the machine tools with digital program control. On the basis of the list, the machine shops jointly with the program control division put together an annual plan for transfer of the machining of the parts to the machine tools with digital program control. This plan which is approved by the chief engineer contains the name of the part, the number of the drawing, the times for preparing and introducing the programs. An equipment list is also compiled in parallel which includes a list of machine tool attachments and tools needed to manufacture the part, the designer, the manufacturer and the manufacturing times.

On the basis of these charts, the machine shops are compiling a plan annually to introduce machining of the parts by the programs. This planning system will permit proper determination of the loading of the machine tools with digital program control and a demand for them and also will insure timely preparation of the programs and equipment.

The calculation and preparation of the programs are done by the program control division. It includes the process shop, the circulation groups, the computer maintenance office and the programming automation group. The calculation groups are attached to the machine shops.

The development and introduction of the programs are realized as follows. The technologists of the machine shops make up a technical assignment for the preparation of the programs for each part. In it the type of billet, the required number of passes and programs, the parameters of the cutting tools, the system for basing and attaching the part (or the machine tool attachment) and the type of machine tool are indicated. On the basis of the technical assignment, the technical office of the program control division develops a process calculation flow chart which indicates the dimensions required for calculating the programs, the trajectory of motion of the cutting tool in the XOY plane and the drops along the Z-axis.

By the dimensions of the drawing and the data from the calculated process flow chart, the calculation groups write the programs for machining the parts. The programs for the milling machines are written using the automated SAPS-9 system executed on the Minsk-32 computer. In order to decrease the volume of initial data in the description of the geometric parameters of the parts having standard elements, 30 procedures have been developed for such elements.

When preparing the programs for the lathes, the Minsk-32, the Nairi and the small R-602 computer built by the Olivetti Company (Italy) are used. The programs are recorded on magnetic tape using the LKI-FM and the UMS-2 interpolators. In order to monitor the correctness of the trajectory of motion of the tool, the UKP-1 and MCh-1 control benches are used.

The programs for machining the parts are checked out and introduced by the program debuggers in the machine shops jointly with the technologists from

the program control division. The first machined parts are accepted by a commission including the technologists, the shop controller and the program control division technologist. By the acceptance results, a document is made up for introducing the program, after which the magnetic tapes are transferred to the shop. The flow chart for machining the parts in which a sketch or diagram of the machining process, the program number, the type of machine tool and attachments, the parameters of the cutting tool, the spindle rpm, the coordinates of the initial point, the machining time are indicated as transferred simultaneously with the tape. On the basis of these data the technologists of the machine shops correct the working documents.

In order to measure the parts with specially complicated outline, the UIP-2 device has been developed for preparing the programs.[1] Its operating principle consists in insuring a constant clearance between the probe installed in the spindle and the machine tool and the surface of the part using electric contact discharge. The control of the placement of the probe along the outline of the part is manual and automatic. The coordinates of the reference points of the outline of the part are read from the dials on the machine tool.

A modification of machine tools with digital program control is also made. For machining parts more than 3000 mm long the length of the longitudinal stroke of the FP-7 machine tool bench was increased to 4400 mm; for machining the parts of greater height, the operating stroke along the Z-axis on the FP-17 machine tool was increased to 800 mm. For machining the fitting parts (of the type of an angle or cross piece), the ATPr2m12s semiautomatic lathe has been modified. On the PFP-5s machine tool the tape drive mechanism of the panel has been finished which has made it possible to run the program not only with normal speed but also at double speed.

In order to establish the defined order of compiling the programs for machine parts and elements of the equipment, the enterprise standard has been developed and put into operation which contains recommendations with respect to laying out the outlines of the parts, machining of which is provided for on the machine tools with digital program control (for the workers in the chief designer's division), the manufacture of standards designed to monitor these parts (for the shop designers), making the drawings for the attachments (for machining and assembling the products), the elements of which are manufactured by the programs (for the designers and manufacturers of the attachments) and for acceptance of the parts (for the technical monitoring equipment workers).

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[1]Author's certificate No 463101 G05B 19/42.

METALWORKING EQUIPMENT

UDC 621.923.6-52

NEW MACHINE TOOLS IN THE USSR

Moscow STANKI I INSTRUMENT in Russian No 2, 1979 pp 32-35

[Text] The model 3614G semiautomatic machine (see the front cover) designed by the Moscow SKTBI Institute and manufactured by the Vitebsk Tool-Grinding Machine Plant imeni 22d Congress of the CPSU is designed for diamond disc grinding of quenched M27-M52 round dies (All-Union State Standard 9740-71) along a curvilinear front surface. The semiautomatic machine built for this operation in the USSR for the first time can be used under the conditions of series and large-series production at the tool plants.

The loading and orientation of the die in the diaphragm chuck, the movement of the stock into the work zone and removal of it, the division by the number of filings openings, cut-in feed, oscillation of the product stock, rocking of the spindle of the grinding stock and unloading are all realized automatically. It is only necessary for the operator to insert the billet into the mechanical arm. The presence of the required blocking insures fail-safe automatic operation of the semiautomatic machine.

On the upper plates of the box-type cast bed, a product stock, a spindle stock and loading mechanism are installed. In the inside cavity of the bed there are the mechanisms for oscillation of the product stock, the electric drive for the reduction gear, the electric spindle and product cooling assemblies, the device for feeding the oil mist to the cutting zone and the container for collecting the finished products.

Before the beginning of the operation of the semiautomatic machine, the operator installs the die in the mechanical arm on the orienting pin, presses the "start" button; the operating cycle continues further automatically. The hydraulic cylinder turns the mechanical arm 90° by means of a ram until it coincide with the axis of the product stock spindle. A terminal breaker responds, which sends an instruction to install the die in the diaphragm chuck. At the end of the die installation pass, the

terminal breaker responds which sends the instruction to clamp the die in the chuck. A pressure relay gives an instruction for the mechanical arm to withdraw. At the end of the withdrawal pass, a terminal breaker responds which sends an instruction to return the mechanical arm to the initial position; at the end of rotating the arm, the terminal breaker responds which sends an instruction to move the product stock into the working zone.

The head of the grinding stock is unlocked simultaneously, and instructions are sent to feed the sleeve and rock the grinding stock spindle. At the end of the feed hydraulic cylinder stroke, a terminal breaker responds which sends instructions (with a dwelling time delay) to withdraw the product stock for division, to brake and lock the grinding stock spindle, switch off the product stock oscillations and return the feed hydraulic cylinder. Then an instruction is sent to unlock the product stock spindle, and on completion of the unlocking, the terminal breaker is sent an instruction for division and displacement of the product stock to the working zone. After machining the last filing opening, the product stock withdraws, and division takes place. On completion of the division, the terminal breaker sends an instruction to return the product stock to the initial position, and on completion of return, the other terminal breaker sends an instruction to unclamp the chuck. The die is knocked out of the diaphragm chuck by a spring pusher. Then the cycle repeats.

The structural design of the semiautomatic machine makes it possible to do unit by unit assembly. With respect to architectural design it is on the level of the best modern machine tools. The control elements are compositionally combined in the optimal operating zone. The semiautomatic device has simplicity and service convenience, and it can be adjusted to another diameter of the machinable dies. It permits organization of multiple machine tool servicing.

The precision of the machining of the dies is characterized by the following indexes: a difference in rakes of the sharpened die on the inside thread diameter of $\pm 5°$, a difference in width of the vanes within the limits of the die lot of ± 0.2 mm. The machined surface roughness $R_a \leq 0.95$ microns. The precision class of the semiautomatic machine is N according to All-Union State Standard 8-71.

Technical Specifications

Outside diameter of the machinable dies, mm	65; 75; 90
Thickness of the machinable dies, mm	14-36
Number of filing openings	5-9
Diameter of the filing openings, mm	11-19
Diameter of the circle on which the filing openings are located, mm	37-61
Machining allowance for machining one vane, mm	0.3-0.7

Diameter of the grinding disc, mm	8
Cutting speed, m/sec	30
Displacement of the grinding stock, mm	45
No of oscillations of the grinding head per minute	70-140
Eccentricity of the grinding disc, mm	0-5
Displacements of the disc, during automatic feed, mm	0-1
Feed of the grinding disc per oscillation, mm	0.01-0,05
Spindle rpm	72 000
Displacement of the product stock, mm	115
Displacement of the product stock for oscillation, mm	6-25
No of double oscillation strokes per minute	180-250
Angle of rotation of the mechanical arm, degrees	90
Power of the main drive, kilowatts	1.5
Overall dimensions of the semiautomatic machine with attached equipment (lengthXwidthXheight), mm	1470X1625X 1900
Weight of the semiautomatic machine, kg	2800

UDC 621.914.4.012.3

The model 6625U plano-milling and boring machine designed by the Ul'yanovskiy GSKB Design Office for heavy machine tools and milling machines and manufactured by the Ul'yanovskiy heavy and unique machine tool plant is designed for machining large products made of cast iron, steel and nonferrous metals by end-type, shank and disc milling cutters.

The machine tool is made with two milling stocks: vertical (slide block) and horizontal (with telescopic tail spindle). The presence of a slide block stock with mounting assemblies permits boring and drilling of the machine tool in addition to milling on five outside and inside surfaces of the part in one setting. For convenience of installing the vertical stock, the mounting assemblies and the heavy tool there is free space on the left column of the machine tool.

The composition of the tool permits high-output milling (using a horizontal stock), drilling and boring in the horizontal plane of the part (using a vertical stock), complete machining of the vertical planes of the parts and machining of the inside surfaces of the large housing part (using an angular head).

In the feed drives, DC electric motors are used, the feed for which comes from thyristor converters. In the main drive of the vertical stock a DC electric motor is used with an adjustment range of 2.5:1 at constant power.

The machine tool is controlled from a suspended panel. The bench displacements are reckoned by a digital display; the digital display is led out to the suspended machine tool control panel. The presence of the digital display permits gig boring of the holes in the part.

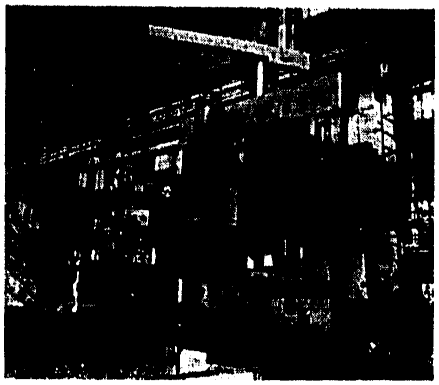

Figure 1. Plano-milling boring machine model 6625U

The assemblies of the machine tool, including the milling stocks, are standardized with the assemblies of the analogous machine tools produced by the plant. The architectural design of the machine tool corresponds to the modern requirements of engineering esthetics.

The model 6625U machine tool is part of a united series of plano-milling and boring machines assimilated at the Ul'yanovskiy Heavy and Unique Machine Tool Plant.

The precision of the machine tool is characterized by the following data: nonplanarity of the upper surface and nonrectilinearity of the lateral surfaces of the part no more than 50 microns over a length of 4000-6300 mm; nonparallelness of the upper surface to the base of the part no more than 80 microns over the same length; nonperpendicularity of the lateral surfaces to the upper surface of the part no more than 35 microns over a length of 500 mm; inconstancy of the diameter of the bored holes no more than 30 microns in the transverse cross section and no more than 40 microns in the longitudinal cross section over a length of 300 mm; nonparallelness of the axes of the holes 300 mm long bored in the part with bench and slide block feed of the vertical stock no more than 30 microns, with feed of the horizontal stock tail spindle of no more than 40 microns; nonperpendicularity of the axis of the bored hole to the milled surface of the specimen no more than 30 microns over a length of 300 mm.

When milling, drilling and boring from four directions in one setting the output capacity is 3.1 times more (with the same machining precision) than for the traditional technology used at the plant for machining parts separately on the milling, drilling, planing and boring machine tools.

Technical Specifications

Dimensions of the operating surface of the bench (widthXlength), mm	2500X8000
Greatest longitudinal stroke of the bench, mm	8500
Speed of fast displacement of the bench, m/min	6-7
Limits of bench feed (continuous regulation), mm/min:	
with shifting	1.5-1000
without shifting	3-2000
Greatest stroke of the slide block stock crossways, mm	4150
Distance from the end of the vertical spindle to the surface of the bench, mm	0-2095
Distance from the end of the horizontal spindle to the middle of the bench, mm	1055-1410
Greatest stroke, mm:	
of the tail spindle	350
slide block	630
Crossbar	1950
Speed (continuous regulation) of the stock spindle, rpm:	
slide block	10-630
with telescopic tail spindle	20-1000
Power of the main drive for the stock, kilowatts:	
slide block	45
with telescopic tail spindle	30
Overall dimensions of the machine tool (lengthXwidthXheight), mm	22500X7250 X7100
Mass of the machine tool (with the electrical equipment), tons	135

UDC 621.941.25-187.4

The model 16M05V high-precision mechanized screw-cutting lathe designed by the Odessa Special Design Office for specialized machine tools and manufactured by the Kirovakanskiy Precision Machine Tool Plant is designed for copy-turning by diamond and hard-alloy tools.

The machine tool is universal, for it provides for turning in the centers, in the chuck, in the collet and also thread cutting (metric, module, inch), and it can be used at the enterprises of the instrument making and tool industry and other branches of precision machine building.

On the machine tool provision is made for automatic maintenance of constant cutting speed when machining step parts with a ratio of the step diameters to 1:4; it has high rigidity and vibration resistance.

On the machine tool provision is made for automation of the copy turning by a hydraulic slide with the servosystem and the longitudinal support assembly; the machine tool can operate with manual and signal-pass automatic displacement cycle of the slide. Hydrostatic bearings are used in the

spindle support. All of the assemblies which are basic sources of vibrations are insulated from the bed.

For determination of the comparative output capacity of the 16M05V and the 16S05A machine tools (the base machine tool) 20 parts of the solid of revolution type (billet material steel 45, machining allowance 0,2 mm) were machined on them by the T15K6 hard-alloyed cutter. It was established that on the model 16M05V machine tool the output capacity is 2.3 times higher.

Figure 2. Model 16M05V mechanized screw-cutting lathe

The machine tool insures (with fastening of the chuck) constancy of the diameter in the transverse cross section within the limits of 1.5 microns, in any cross section within the limits of 3 microns in a length of 100 mm; uniformity of the pitch of the thread within the limits of 7 microns in a length of 50 mm; nonplanarity of the end surface no more than 2.4 microns on a diameter of 100 mm.

Technical Specifications

Greatest diameter of machined product, mm:	
above the bed	250
above the slide	145
Greatest length of machined product, mm	500
Greatest dimensions (diameterXlength) of the product machined by the hydraulic slide, mm	80X420
Greatest bar diameter, mm:	
running through the spindle opening	26,5
installed in the collet	17
Maximum spindle rpm (continuous regulation), rpm	16-3200

Pitch of cut thread:	
metric, mm	0,2-28
module, mm	0,1-14
inch, number of threads per inch	96-5
Power of the main drive, kilowatts	2.35
Overall dimensions of the machine tool (lengthXwidth Xheight), mm	1995X935 X1580
Mass of the machine tool (with electrical equipment and with purchased hydraulic unit), kg	1910

UDC 621.924.3-187.4

The model 3Ye711YeV-1 high-precision surface grinding machine with cross bench and horizontal spindle and with a projector for shaping operations designed by the Vitebsk Special Design Office for gear-cutting, grinding and tool-grinding machine tools (SKBZShS) and manufactured by the Orshanskiy Krasnyy Borets Machine Tool Building Plant is designed to machine faced surfaces by the method of outlining with respect to an enlarged drawing fastened to the projector screen.

Face dressing of the grinding disc up to 40 mm wide, machining of the face profile of the product and flat surfaces are possible on the machine tool.

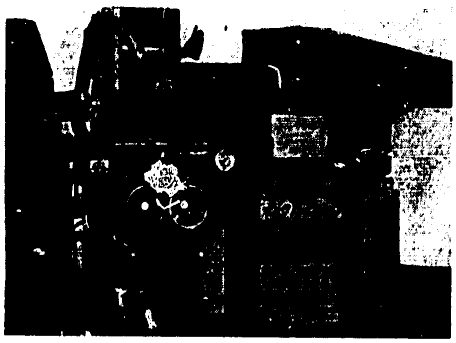

Figure 3. Model 3Ye711YeV-1 surface grinding machine tool

The machine tool is part of a complex range of surface grinding machine tools with a cross bench and horizontal spindle; this range was developed by the Vitebsk SKBZShS Special Design Office and has been assimilated by the Orshanskiy Krasnyy Borets Machine Tool Building Plant. The 3Ye711YeV-1 machine tool is structural similar to the range of machine tools, and the degree of its standardization with them is up to 77%.

The structural peculiarities of the machine tool are as follows: 1) grinding head, bench and cross slide are mounted on steel reinforced swing guides; 2) the base parts of the machine tool have greater manufacturing precision and rigidity; 3) in the machine tool, in addition to the basic grinding head provision is made for an oscillating grinding head; 4) the hydraulic units and in part the control unit are led out from the machine tool bed; 5) lubrication is fed to all of the working elements and the working surfaces in the machine tool; 6) the volumetric and spatial structure of the machine tool corresponding to the requirements of industry is characterized by efficient and functionally expressed composition of the basic forming elements (the bed, the bench, column, control unit, electric bay and projector); 7) proportional and scaling ratios of the bed and bench, the bed and control unit, the control unit and the electric bay, expressive shape of the dials, the control handles and the housing of the grinding disc correspond to the high esthetic quality of the machine tool.

After machining on this machine tool, the surface error is no more than 60 microns (with 10-fold magnification of the drawing) and no more than 10 microns (with 50-fold magnification); the roughness is no more than R_a=0.5 microns.

Technical Specifications

Greatest dimensions of the machinable product (lengthXwidth), mm	220X200
Greatest height of the product, mm:	
during operation of the basic grinding head	220
during operation of the oscillating grinding head	165
Greatest distance from the spindle axis of the grinding disc to the surface of the bench, mm	445
Greatest cutting spped, mm/sec	35
Spindle rpm of the grinding disc, rpm	2670
Overall dimensions of the projector screen (widthXheight), mm	400X400
Magnification of the projector	X10; X25; X50; X100
Power of the main drive, kilowatts	2.2
Overall dimensions of the machine tool (lengthXwidth Xheight), mm:	
without consideration of the attachment equipment and the stroke of the moving parts	1700X1700 X1915
with consideration of the attachment equipment and stroke of the moving parts	2850X2400 X1915
Weight of the machine tool, kg:	
without attached equipment	2400
with attached equipment	3200

UDC 621,924,6-187,4;621,833.382

The model 5K881, high-precision, semiautomatic worm grinding machine designed and manufactured by the Moscow Gig Boring Machine Tool Plant is designed for grinding various shapes of single and multithread worms during series or large-series production in the automobile, machine tool building and other branches of industry.

The shape of the worms is ground by a single-thread disc in the semiautomatic cycle with operating stroke of the bench in one or two directions.

The semiautomatic machine enters into the composition and the complex range of thread grinding and worm grinding machine tools; the degree of its standardization with the machine tools is up to 80%. The following standardized assemblies are used in the semiautomatic machine: the grinding stock, the drive of the devices for dressing the disc, the compensation mechanism, the grinding disc spindle, the machine tool housing, the lubrication tanks, cooling tanks, and so on.

Figure 4. Model 5K881 semiautomatic worm grinding machine

The semiautomatic machine has the following structural peculiarities and advantages by comparison with its prototype (the model 5881). For automatic variation of the product spindle rpm range and the dressing speed of the grinding disc during rough and finish passes a thyristor drive is used in the automatic cycle. A new, more rigid structural design of the drum-type grinding stock will permit simultaneous rotation of the device for dressing the disc by the helix angle · of the worm spiral, the electric motor of the disc spindle drive and the disc spindle. Volumetric formers are used to dress the grinding disc, which made it possible to reduce the adjustment time.

The power of the electric drive motor for the product is increased to 1.15 kilowatts. The semiautomatic unit is inclosed in a common housing with the telescopic screens. The rotating control panel is conveniently located in the service zone. The structural design of the mechanism for

transverse feed of the grinding stock insures the possibility of using automatic transverse feed or manual feed (independently of each other).

The precision of this semiautomatic machine is characterized by the following data: when machining worms with modules 6 mm and 6 threads the deviation of the axial pitch is no more than ±9 microns; the radial beat of the worm turns is no more than 12 microns; when machining worms with 3 mm module and 3 threads, the deviation of the axial pitch is no more than ±7 microns, radial beat of the worm turns is no more than 9 microns; when machining single-thread worms with a 3 mm module the deviation of the axial pitch is no more than ±4.5 microns, the radial beat of the worm turns is no more than 5 microns. The roughness of the machined surfaces is no more than R_a=0.5 microns.

On the semiautomatic 5K881 machine, an increase in precision of the worms by 1 degree of precision is achieved in accordance with ST SEV 311-76 and an increase in output capacity by 1,67 times by comparison with the precision and output capacity achieved on the model 5881 semiautomatic machine.

Technical Specifications

Greatest dimensions of the installed product, mm:	
diameter	125
length	360
Greatest stroke of the bench, mm	270
Parameters of the ground worms:	
diameter, mm	2-125
module, mm	2-6
number of threads	1-6
greatest helix angle, degrees	±35
Cutting speed (with a disc diameter of 400 mm), m/sec	35; 50
Limits of product rpm:	
operating	0.3-45
accelerated	no more than 82
Power of the main drive, kilowatts	3 (by special order, 5,5)
Overall dimensions of the semiautomatic unit (lengthXwidthXheight), mm	1810X2050 X1710
Weight of the semiautomatic unit, kg:	
without attachment equipment	4300
with attachment equipment	5505

UDC 621,923,5.-112-52

The special model VSh-680 automatic spherical grinding machine designed by the Vitebsk SKBZShS Special Design Office and manufactured by the Vitebsk Machine Tool Building Plant imeni Kirov is designed for continuous grinding of the spherical ends of conical rollers or roller bearings under the conditions of large-series and mass production.

The especially high precision automatic machine corresponds to the requirements of the industry, it is standardized with the centerless grinding machines produced by the machine tool plant. The architectural design of the automatic machine corresponds to the modern requirements of engineering esthetics.

The horizontal spindle of the grinding disc is installed on the hydrodynamic bearing which insures high operating qualities, service life and vibration resistance of the automatic machine.

The grinding stock is displaced along the closed swing guides; its stroke provides for replacement of the grinding discs without additional withdrawal of the product stock. The latter has established displacement and rotation in the horizontal plane; after adjustment of the automatic machine it is locked on the bed. The machine is provided with a disc dressing mechanism.

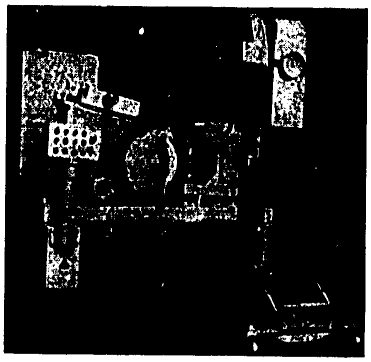

Figure 5. Model VSh-680 special automatic spherical grinding machine

The precision of grinding the conical rollers is characterized by the following indexes; beating of the spherical end of the rollers no more than 3 microns; deviation of the radius of the sphere no more than 0-16 microns; surface roughness R_a=0,16 microns.

By comparison with the output capacity of the other machine tools for machining conical rollers, the output capacity of the automatic machine is 3.6 times lower.

Technical Specifications

Length of the installed rollers, mm	4-25
Radius of machined sphere, mm	60-210
Diameter of grinding disc, mm	500
Cutting speed, m/sec	35-28
Speed, rpm:	
of the separator	0.5-10
of the drive discs	20-120
Power of the main drive, kilowatts	11
Overall dimensions of the automatic unit without the loading mechanism (lengthXwidthXheight), mm	2325X1900 X2245
Weight of the automatic machine (with attachments entering into the basic set), kg	6537

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CSO: 1821

METALWORKING EQUIPMENT

UDC 621.331.876.4

SOCIALIST COMPETITION OF LABOR COLLECTIVES IN THE THIRD YEAR OF THE TENTH FIVE-YEAR PLAN

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[Article by V. P. Demin]

[Text] The national economy of our country is developing dynamically, and the efficiency of social production is rising. The party and the government have unswervingly taken a course toward the acceleration of scientific and technical progress, the improvement of control, the intensification of organization in each work area.

The grand problems of the building of communism advanced by the 25th Congress of the CPSU impose high requirements on the activity of the labor collectives and each worker. Under these conditions an ever greater role will be played by the level of consciousness, culture and civil responsibility of each worker.

Concentrating the efforts of the collectives of the associations, plants and organizations on the fulfillment of the assignments of the Tenth Five-Year Plan, the economic leaders and committees of the trade union under the direction of the party organs are developing socialist competition more and more broadly, they are introducing advanced methods of labor more effectively.

A distinguishing feature of the socialist competition on the modern level is the effort to achieve the best final results and high qualitative indexes and to make them the standard of the day.

Many of the collectives of the associations and enterprises of the branches for automobile building, instrument making, farm machine making, machine building for animal husbandry and feed production, machine tool building, heavy, transport and power engineering machine building are successfully carrying out the plans and the adopted socialist obligations with respect to sale of production, growth of productivity of labor, increase in proportion of the production of the higher quality category in the overall production volume. Good results have been achieved by the collectives of the Bryansk Machine Building Plant Association, the Transmash Association

(Moscow), Konveyer Association (L'vov), the Khabarovsk Dal'dizel' Plant, the Southern Urals Machine Building Plant Yuzhuralmash, the Lyudinovskiy Diesel Locomotive Building Plant and many others.

Measures are taken with respect to the further improvement of the technical level of the manufactured machines, instruments, machine tools and equipment. Before the end of the current five-year plan at the enterprises of the Ministry of Instrument Making and Ministry of Machine Building Industry, the proportion of the production of higher quality category in the overall production volume is planned to reach 40%, and at the enterprises of the Ministry of Light Industry and Food Machine Building, to 30%.

In many of the associations and at the plant the achievement of higher goals and improving production quality has become the primary direction of socialist competition.

More than 600,000 machine builders and instrument makers are participating in the competition under the motto of "Five-Year Plan of Quality -- Working Guarantee."

The collectives of Moscow Machine Tool Building Production Association Krasnyy Proletariy, Gomel' Machine Tool Building Plant imeni S. M. Kirov, Orlovo Control Computer Plant, and so on are producing more than half of their production with the state symbol of quality.

In the Ministry of Instrument Making and the Ministry of Machine Tools Industry, a branch production quality control system is being introduced. In the instrument making branch, a united procedure has been developed and is in operation for evaluating the work of the collectives of the production associations and the enterprises with respect to the support of production quality. Here the proportion of new production and the proportion of products certified for the state symbol of quality in the overall production volume, the level of rhythmicity, the reduction of the number of advertisements and losses from rejects, the presence of second quality category products and cases of economic sanctions are taken into account.

On the basis of the generalized coefficient of operating quality of the associations and enterprises determined in accordance with a united procedure, in the branch a new system of material incentive of the administrative workers is being introduced.

The collective of the Baku Oil Field Machine Building Plant imeni Montin is working in shock labor fashion. Over the extent of a number of years it is constantly dealing with the class places in the All-Union Socialist Competition. During 2 years of the Tenth Five-Year Plan, the productivity of labor has increased by more than 30%. At the plant socialist competition is widely developed under the motto of increasing the personal contribution of everyone to the improvement of the production efficiency and operating quality, which will insure achievement of high and stable indexes in work.

More than 33% of the total production volume is produced with the state symbol of quality. At the plant the personal plans of the workers are being introduced to improve the productivity of labor; the assignments of the state plan are delivered to each member of the collective. The normatives for the growth of productivity of the piece workers have been calculated as a function of the level of satisfaction by them of the output norms for the defined period. Depending on the fulfillment of the personal plan the piece workers receive bonuses in the amount from 10 to 25% of their wages. At the plant broad use is made of the piece rate system of payment for labor with respect to final results, and measures are taken with respect to timely reexamination of incomplete norms and assignments.

When developing the conditions of socialist competition, factors are taken into account which have an influence on the improvement of the efficiency of production and the quality of work. All of the enterprise workers are involved in socialist competition; the application of the differentiated criteria for evaluating labor will permit proper determination of the personal contribution of each worker to the final operating results of the enterprise and finding of production reserves.

The competition of the engineering and technical workers with respect to personal creative plans has had a significant effect on the improvement of the shift coefficient of the operation of the equipment, improvement of the quality of the production output and rhythmicity of operation.

At the joint meeting of the board of the Ministry of the Chemical and Petroleum Machine Building and the Presidium of the Central Committee of the Trade Union of Workers in Heavy Machine Building, the Rules for Intraplant Socialist Competition at this plant were approved which were recommended for application at other related enterprises.

The practice of socialist competition is being constantly enriched by new forms of organization of it, the creative search is leading to high final results, acceleration of the rates of technical progress, and further improvement of qualifications and mastery.

The administration, the social organizations of the Minsk Refrigerator Plant are giving constant attention to the development of the creative activity of the workers, the finding and use of the production reserves, the improvement of the organization of socialist competition for successful fulfillment of the assignments of the Tenth Five-Year Plan, improvement of the production efficiency and operating quality. About 80% of the piece workers of this plant are successfully fulfilling the personal plans for improvement of the productivity of labor confirmed by economic and engineering calculations.

The engineering and technical workers are involved in planning the internal production reserves. Many of them have personal creative plans, they are in competition under the motto of "Engineering Support of the Workers' Initiative," they are participating in the mechanization and automation of production in the efficiency expert activity.

At this plant a structured system has been developed for improving the qualifications of the plant workers. In the courses for advanced training in the schools of communist labor and economic skills, the workers are studying new equipment and technology, the principles of the scientific organization of labor and advanced work experience.

The mentorship program and the movement under the motto "No One Lagging Behind" have become widespread at the plant. Measures are being taken with respect to reducing the nonproductive losses of work time, reinforcement of the labor and production discipline. The necessary conditions are being created for highly productive labor. About 1500 of the people are working in the work areas organized with respect to the standard designs.

At the enterprise systematic work is being done with respect to reexamination of the existing development norms and replacement of them by more advanced ones. The proportion of the technically substantiated development norms is more than 90%. The assignments with respect to reducing the labor consumption are being overfulfilled constantly.

In order to accelerate the growth of the productivity of labor at the plant, the bosses for reducing the labor consumption of production, for working by the technically substantiated norms, fulfillment and overfulfillment of the standardized assignments and personal plans for improvement of the productivity of labor are widely practiced. The payments for combining professions, expansion of the service zone and work with purer personnel than the norm provides for are being used effectively.

The practice of the development and realization of counterplans in the Minsk Tractor Plant Association has become an important form of manifestation of the creative activity of the labor collective promoting a significant increase in production efficiency. The compilation of the counterplan draft in the association includes the permanently operating production conferences, the social offices of economic analysis, and the organization of the scientific and technical societies.

In 1978 the counterplan provided for the manufacture and sale of 4 million rubles more production than for the assignments of the fifth year plan for this year and obtaining an additional 400,000 rubles of profit. This situation is being successfully accomplished.

In the third year of the five-year plan, the association must deliver 87,000 machines to agriculture. The production of the new type MTZ-80 tractors has been significantly increased, and savings have been insured in metal rolled products, electric power, fuel, financial and labor resources.

At the machine building enterprises a great deal of experience has been accumulated in the provision of incentives for shock labor. The existing

bonus systems provide for rewards for the basic results of the production activity, high final results, growth of the productivity of labor, improvement of the utilization of equipment, rhythmicity of production, the development and introduction of new equipment. The specific application of material incentives in the Volzhsk Automobile Plant Association is promoting rhythmicity of the high quality production output and interest in advanced training of the personnel.

A system of awards for the development of modern metallurgical equipment has been developed and is being efficiently used at the Uralmash Association.

It will be completed in 1978. In the association, enterprises and organizations, the achieved results are being critically considered, the paths of further improvement of the economic mechanism are being planned. Without a sense of high responsibility, fines, mutual demands, skill in seeing the future, assuming everything new and advanced as applied to the conditions of production, it is impossible to achieve high goals. In connection with the growth of the production scales and complication of the national economic goals, this approach is acquiring special significance. The reserves at many of the enterprises are great, the primary goal is more actively to place them in the service of the five-year plan.

It is especially important to organize affairs in all production sections so that the plans and the adopted socialist obligations will be implemented faster, with least labor and material expenditures.

It is necessary more clearly to determine the basic criteria of estimating the activity of the participants in the socialist competition, to give preference to the collectives which successfully implement the stressed counterplans, make better use of the available reserves, and improve the level of loading the equipment and the use of production capacity, and achieve an increase in the production efficiency and operating quality.

Any cases of disruption of the planned assignments and adopted socialist obligations must be the subject of careful analysis, discussion, theoretical estimation of the activity of the lagging collective, and aid measures must be planned here. It is necessary to stop the violations of state discipline, uneconomicalness, poorly thought out decisions, and irresponsible attitudes toward the work section with which they are charged.

In the labor collectives measures are taken for the further development of socialist competition in order to create a sound basis for the Tenth Five-Year Plan as a whole. The high patriotic uplift, the selfless labor in all sections are promoting successful realization of the grandiose problems stated by the 25th Congress of the CPSU.

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