Economic Intelligence Report

TRENDS IN SOVIET PRODUCTION OF METALLURGICAL EQUIPMENT FOR THE STEEL INDUSTRY 1959–65

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TRENDS IN SOVIET PRODUCTION OF METALLURGICAL EQUIPMENT FOR THE STEEL INDUSTRY* 1959-65

Summary and Conclusions

The USSR plans to produce 1.7 million tons** of metallurgical equipment during the Seven Year Plan period (1959-65), a substantial increase of 55 percent above the amount produced during 1952-58. Most of this equipment is intended to meet the growing requirements of the Soviet economy, mainly the steel industry, but substantial amounts are to be exported, primarily to Bloc countries and to a lesser extent to underdeveloped countries. Increased production is to be achieved primarily by expanding and modernizing existing plants of the metallurgical equipment industry. New construction to date during the plan period has been limited to minor facilities for production of specialized equipment. The only major plant scheduled to be put under construction during the plan period is a rolling mill equipment plant at Petropavlovsk. Originally scheduled for completion during the Sixth Five Year Plan (1956-60), this project has been repeatedly delayed, and it probably was not expected to make a significant contribution to production during the Seven Year Plan.

In 1961 the USSR produced 213,900 tons of metallurgical equipment, slightly less than the 218,300 tons produced in 1960. The decline in production in 1961 followed increases in production of 14 percent and 9 percent, respectively, in 1959 and 1960. The total production in 1959-61 of 633,000 tons was behind schedule for fulfillment of the plan for aggregate production of metallurgical equipment during 1959-65. To meet this goal, the USSR must achieve an average annual production of 273,000 tons during 1962-65 compared with an average annual production of 211,000 tons during 1959-61 -- a formidable task in view of perennial Soviet failures to meet production plans and the evidence discussed below that construction of new capacity is behind schedule.

In the case of rolling mill equipment, which normally accounts for 50 to 60 percent of the total production of metallurgical equipment, performance has been particularly poor. In 1961 the USSR produced 102,100 tons of rolling mill equipment, not only substantially below the planned output of 150,000 tons but also less than the 120,600 tons produced in

* The estimates and conclusions in this report represent the best judgment of this Office as of 15 December 1962.

** Tonnages are given in metric tons throughout this report.

1960. Although increases in production of 18 percent were achieved in both 1959 and 1960, they followed a trend of declining production in 1957-58. The average annual production of rolling mill equipment in 1959-61 was approximately equal to the average production in 1955 and 1956, the previous peak years for production of this type of equipment. To reach the production goal for 1965 of 200,000 to 220,000 tons of rolling mill equipment, the USSR must approximately double its output in 1961. Achievement of the plan for the aggregate production of rolling mill equipment during the plan period appears to be even more difficult. The USSR plans to produce at least 1 million tons and possibly as much as 1,144,000 tons of rolling mill equipment during 1959-65. These plans would require an average annual production during 1962-65 of 169,000 to 205,000 tons compared with an average annual production of 108,000 tons during 1959-61.

One reason for the inability to achieve the planned production of metallurgical equipment is the failure to expand machine building capacity sufficiently. The USSR appears to be behind schedule in its investment program at major plants of the industry that are expected to provide most of the planned increase in production. Only at the Ural Heavy Machine Building Plant (Uralmash) at Sverdlovsk does substantial progress appear to have been made in constructing and enlarging facilities, although, for the most part, they were still not in use during the first half of 1962. Some progress has been reported in modernization of other major plants, but construction of new facilities has lagged. In some cases, there is little evidence of significant investment at plants with important production responsibilities during the plan period. For example, no new construction has been reported at the Elektrostal' Heavy Machine Building Plant, which is scheduled to produce most of the pipe and tube mills planned during 1959-65. Another deficiency is the lack of progress in establishing specialized machine building facilities for production of mechanical equipment needed in mechanization programs for the steel industry. Actual declines in production in 1961 and earlier years may be explained in part by heavy competing demands placed on plants of the industry for other types of industrial equipment.

Failure to produce the desired quantities and types of metallurgical equipment required by the Soviet steel industry also can be attributed in part to difficulties in planning and designing. Faulty planning by the steel industry itself in undertaking expansion and introducing new technology has hampered efforts to establish stable, well-defined plans for production of metallurgical equipment. Many of the problems can be traced to the cumbersome planning system requiring coordination at Gosplan, design institutes, and lower administrative levels as well as at machine building and steel plants. For example, difficulties in coordinating planning, designing, and related construction activities help to explain the lengthy lead times required for major rolling mill projects. Each of the three continuous wide strip mills that the USSR has

put into operation during the current plan period required 5 years or more for completion. Similar difficulties have slowed work on cold rolling mills and finishing equipment. The lag in undertaking the task of equipping new basic oxygen steelmaking shops appears to be the result of indecisive planning as well as delays in solving technical and design problems.

Although shortfalls in production of metallurgical equipment are one reason for delays in commissioning new iron and steel capacity, they have not seriously affected the growth in the total production of iron and steel -- even toward goals revised upward since the start of the plan period. Delays in the construction of new capacity in the steel industry have been offset by success in obtaining substantially increased production from existing facilities. Moreover, the equipment industry has performed creditably in building large-capacity equipment units of modern design. The new coke batteries, blast furnaces, and open-hearth furnaces constructed and equipped by the USSR rank with the largest in the world. The rated capacities of some of the new Soviet rolling mills also compare favorably with those in the US and elsewhere in the West.

Nevertheless, shortfalls in production of metallurgical equipment may affect important programs of the Soviet steel industry other than those for over-all increases in production. For example, delays in commissioning new iron and steel capacity may adversely affect plans for retirement of obsolete equipment. Of greater concern, however, are shortages of specific types of equipment required by the steel industry for planned improvements in the variety and quality of its finished products. Among the major types of equipment that the USSR has encountered difficulties in manufacturing in adequate numbers and variety are cold rolling mills, finishing line equipment (such as continuous lines for galvanizing and electrolytic tinning), pipe mill equipment, and heat-treating furnaces for steel mill products (including tubular products). In addition, the quantities of materials-handling and auxiliary equipment now being produced apparently are insufficient for the pace planned for mechanization and automation of the steel industry.

As the principal Bloc producer of metallurgical equipment, the USSR plays a key role as a supplier of equipment to steel industries in the Bloc. During 1955-60 the USSR was a substantial net exporter of metallurgical equipment, most of which was rolling mill equipment, in spite of significant imports of rolling mill equipment from Czechoslovakia and East Germany. Although since 1960 several Bloc countries, especially Czechoslovakia, have become more important as suppliers of rolling mill equipment in intra-Bloc trade and to some extent in trade with underdeveloped countries, the USSR remains the principal supplier within the Bloc of larger and more complex types of rolling mills. Commitments to

the Bloc for such equipment as well as scheduled shipments of various types of metallurgical equipment to underdeveloped countries, mainly India and Egypt, call for the continuation of a high level of Soviet exports through the remainder of the plan period.

A significant development in recent years has been the acquisition by several of the European Satellites of substantial amounts of equipment from Western manufacturers and the placing of orders for additional Western equipment for delivery during the next several years. The main interest has been shown in modern types of equipment needed to expand and diversify production of finished steel. Although the USSR is providing some of the particular types being ordered and sought from the West, such as cold rolling mills and pipe mill equipment, the Soviet lag in relevant technology and the inability to manufacture adequate amounts of finishing facilities for its own needs apparently explain the trend toward procurement from the West.

The USSR itself has imported only comparatively small amounts of auxiliary rolling mill equipment from the West and is not known to have ordered complete installations for rolling or finishing steel products. On the other hand, faced with a lag in the development of its basic oxygen steelmaking program, the USSR has been negotiating since 1960 for acquisition from Austria of L-D* oxygen converter equipment and technology.

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* The designation L-D stands for Linz-Donowitz in Austria, where the basic oxygen process was developed, and it is commonly used to designate the process.

I. Introduction

In view of Bloc-wide efforts to expand output of iron and steel, programs to strengthen Soviet capabilities for production of metallurgical equipment are of special interest. This is particularly true inasmuch as the USSR not only produces most of the metallurgical equipment for its own steel industry but also is the principal supplier of metallurgical equipment imported by other Bloc countries. The purpose of this report is to describe briefly the Soviet metallurgical equipment industry and to examine its progress and problems during the first half of the current plan period in light of domestic and export demands placed on it. Of considerable importance in assessing progress in the metallurgical equipment industry are Bloc programs to adopt new technology in the steel industries and to improve and diversify production of finished steel. Problems encountered by the USSR, the principal Bloc producer of metallurgical equipment, in manufacturing some of the required new types of equipment acquire special significance in the context of an incipient trend of increased dependence of the European Satellites on Western manufacturers of equipment.

This report is confined to a discussion of metallurgical equipment for the steel industry. As discussed herein, the steel industry consists of the plants engaged in production of metallurgical coke, pig iron, crude steel, and steel mill products, including pipes and tubes. Iron ore mining and processing equipment is not considered to be metallurgical equipment for the purposes of this report.* Metallurgical equipment for the steel industry includes the following types of equipment:

1. Mechanical equipment required at coke plants (excluding byproduct chemical facilities), blast furnaces, and steel smelting shops, such as coke pushers, coke-oven charging larries, door extractors, coke guides, quenching cars, ore bridges, ore unloaders, conveyor systems, skip hoists, slag pots, mixers, charging machines, ladles, casting installations, ingot buggies, overhead traveling cranes, and other special handling mechanisms.

2. Rolling mills and auxiliary equipment for handling, processing, and finishing steel products. Rolling mills encompass a wide range of mills from primary mills for the breakdown of steel ingots (such as blooming and slabbing mills) to mills for the rolling of

* Soviet production and planning data for metallurgical equipment exclude ore mining and processing equipment.

diversified steel products, including flat and tubular products, rod and wire, and a wide variety of shapes and sections (such as rails, beams, channels, angles, and bars). Examples of auxiliary equipment, which also covers a wide range of installations, include transfer equipment, shears, slitting lines, levelers, coilers, pickling lines, tinning and galvanizing lines, and heat-treating equipment.

3. Fabricated components that are part of the technical equipment (such as blast furnace bells, coke-oven doors, and machinery supports). Such components may be distinguished from the building, concrete work, structural steel, and other structural elements needed in the construction of coke ovens, blast furnaces, and steel furnaces.

Metallurgical equipment as thus defined also must be distinguished from a wide variety of other installations and ancillary facilities essential to the efficient operation of modern iron and steel plants. Examples include power plants, pump rooms, turboblowers and compressors, electrical drives and other electrical equipment, oxygen generating facilities, instruments, measuring and control equipment, refractory materials, railroad tracks, docks, and storage facilities. Equipment and facilities of these various types are supplied by many branches of industry.

II. Structure of the Industry

A. Production Facilities

The Soviet metallurgical equipment industry, a major branch of the machine building industry, consists of a diversified group of machine building plants of which only a few are engaged solely in production of metallurgical equipment for the steel industry. In fact, the wide variety of industrial machinery and equipment produced by these plants precludes easy identification and itemization of industry resources such as labor force and production facilities. The major producers of metallurgical equipment are heavy machine building plants with casting, forging, metalworking, and handling facilities required in the manufacture of large and heavy products. Eight of these plants account for much of the production of metallurgical equipment and nearly all of the production of rolling mill equipment that normally constitutes about 50 to 60 percent of the total production of metallurgical equipment.*

In spite of the importance of this nucleus of heavy machine building plants, dozens of other industrial plants produce various

* For a list of these major plants and their principal metallurgical equipment products, see Appendix A.

types of metallurgical equipment. Heavy machine building plants in Debal'tsevo, Zhdanov, Syzran', and Krasnoyarsk are significant producers of ladles, charging machines, and other materials-handling equipment as well as components for rolling mills and blast furnaces. Hoist and transport equipment plants in Leningrad and Moscow produce metallurgical cranes. Among the more important producers of rolls for rolling mills are specialized plants in Dnepropetrovsk and Lutugino.* The Slavyansk Machinery Plant is an important specialized producer of machinery for coke batteries. The Starostin Machine Building Plant in Odessa is the only specialized producer of weight-measuring machines for blast furnaces, steel mills, and rolling shops. Several electrothermal equipment plants collaborate with heavy machine building plants in the building of electric furnaces for the steel industry. Electrothermal equipment plants in Novosibirsk and Moscow have participated in the manufacture of equipment for electric furnaces up to 80 tons in capacity, and the Electrothermal Equipment Plant in Saratov has participated in the manufacture of small-capacity units, primarily under 3 tons.

Metallurgical plants themselves meet most of their extensive requirements for spare parts and replacement components and produce some equipment for modernization and reconstruction of their facilities. In addition, an extensive network of suppliers from many branches of industry provide materials and specialized components, such as electric drives and other electrical equipment, instruments, control devices, lubrication systems, ball bearings, and gears.

B. Administration

The plants of the metallurgical equipment industry, which, before the industrial reorganization of 1957, were controlled by the Main Administration for Metallurgical Machine Building (GUMMASh) of the Ministry of Heavy Machine Building are now subordinate to local economic councils (sovnarkhozes). On the other hand, these plants are still subject to a considerable degree of centralized control. The State Institute for the Design and Planning of Metallurgical Plants (GIPROMEZ) is directly responsible for the establishment of equipment requirements of the Soviet steel industry, which form the basis for production plans for metallurgical equipment. In addition, Gosplan and organizations such as the State Committee for Ferrous and Nonferrous Metallurgy issue directives concerning assignments for production of metallurgical equipment. Nevertheless, heavy competing demands placed on these plants by sovnarkhozes and other planning bodies frequently result in delays in completing and delivering orders for metallurgical equipment.

* Most of the rolls produced by these plants are replacement rolls for rolling mills already in operation in the steel industry and are not reflected in the annual production data (tonnage) for metallurgical equipment.

C. Research and Designing

In drawing up plans for metallurgical plants, GIPROMEZ and its affiliates at republic and local levels must coordinate the work of numerous scientific, research, and design organizations. Of fundamental importance because of its relevance to trends in the design of metallurgical equipment is research in iron and steelmaking processes conducted by research institutes and steel plant laboratories. The Central Scientific Research Institute of Ferrous Metallurgy (TsNIIChM) devotes part of its research effort in ferrous metallurgy to equipment problems. GIPROMEZ does a considerable share of the designing of metallurgical equipment but delegates responsibility for most of this work to design staffs of machine building plants as well as to several specialized organizations, mainly the State Institute for the Design and Planning of Coke-Chemical Enterprises (GIPROKOKS); the State Institute for the Design and Planning of Steel Works (GIPROSTAL'); the State All-Union Design and Planning Institute for Ferrous Metallurgy ("Stal'proyekt"); and the All-Union Scientific Research Institute for Heat Treating Equipment (VNIIETO), formerly the Electric Furnace Special Design Bureau. In the development of designs of new models of equipment, particularly rolling mills and auxiliary equipment, a major role is played by the All-Union Scientific Research and Planning-Design Institute of Metallurgical Machine Building (VNIIETMASh), which frequently collaborates with designers at the plant level. The Central Scientific Research Institute of Technology and Machine Building (TsNIITMASh) also helps to develop new models of metallurgical equipment. Another important function of TsNIITMASh is to conduct research programs concerning properties of materials, manufacturing processes, and other technical problems of machine building.

III. Development of Capabilities

A. General

The USSR plans to achieve Seven Year Plan goals for production of metallurgical equipment primarily by expanding and modernizing existing plants of the metallurgical equipment industry. Increased specialization in the manufacture of various types of metallurgical equipment also is expected to help make possible higher output. 1/* The only new construction reported to date during the plan period has been on minor facilities for production of specialized equipment. Only one major machine building plant, to be located at Petropavlovsk, has been scheduled to be put under construction during the plan period, but work on this project has not yet been started. It is not likely that Soviet planners are counting on this plant for a significant contribution to production during the Seven Year Plan.

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B. New Construction

In April 1962 it was announced that work had been completed on a plant in Armenia for the manufacture of vacuum furnaces needed for production of high-quality steel. 2/ No additional information is available concerning this plant. Construction is underway on a plant at Zhdanov to manufacture steel fabrications for steel converters, earthmoving machinery, and other equipment. The first section of the plant was scheduled for completion in 1962. 3/

The only known project for construction of a major machine building plant is a new rolling mill equipment plant at Petropavlovsk. Originally scheduled for completion during the Sixth Five Year Plan, this project has been delayed repeatedly. In 1960 it was announced that construction was to be started in 1962. 4/ The current status of this project is not known, but at best, even with an early start on construction, the plant probably could be only in partial operation by 1965.

C. Expansion of Existing Plants

Much of the planned increase in production of metallurgical equipment is expected from four plants: the two largest plants, the Ural Heavy Machine Building Plant (Uralmash) at Sverdlovsk and the Novo-Kramatorsk Heavy Machine Building Plant, as well as the Elektrostal' Heavy Machine Building Plant, which is to produce most of the new Soviet pipe and tube mills during the plan period, and the South Ural Heavy Machine Building Plant at Orsk, which is scheduled for major expansion. Planned production of rolling mill equipment by Uralmash during 1959-65 is 307,000 tons, or slightly more than the amount produced during the preceding 25 years. 5/ At the Novo Kramatorsk plant the annual production of rolling mill equipment is to be tripled during the plan period. 6/

At Uralmash, many of the major shops are being expanded, including the steel foundry, the press and forge shop, and a machine assembly shop. A new shop for production of rolls for rolling mills was completed near the end of 1961. 7/ A large shop for welded fabrications has been partly completed. Early in 1962, equipment was being installed in the six bays of the first section while construction was underway on a second section with seven bays. 8/ Other new facilities nearing completion are a large laboratory building and experimental shop. 9/

At the Novo-Kramatorsk plant the only known new construction is the recently completed engineering wing with library, office, and other facilities for designers at the plant. 10/ On the other hand, there is evidence of progress in the modernization and enlargement of

equipment facilities at the plant as well as installation of new equipment. Some 200 new machine tools were installed in various shops at the plant in 1960. 11/ An increase in steelmaking capacity also was made that year by reconstruction and enlargement of the open-hearth furnaces at the plant. 12/ In 1961 the Novo-Kramatorsk plant installed induction heat-treating equipment and an installation for vacuum degassing of large steel ingots up to 100 tons. 13/ Early in 1962 it was announced that electroslag remelting facilities had been installed for casting of high-quality steel ingots up to 10 to 12 tons. 14/

Scheduled construction projects at the South Ural Heavy Machine Building Plant, which reportedly is to have its total machine building capacity doubled during the plan period, include a new metal structures shop and a new section of the open-hearth shop. Work was underway on these projects near the end of 1961, but scheduled completion dates are not known. 15/ Although some modernization of foundry facilities has been accomplished at the Elektrostal' plant, there is no indication that new construction has been undertaken or planned at this plant.

Capacities of other major plants are to be increased. At the Staro-Kramatorsk Heavy Machine Building Plant a new steel casting shop was commissioned in 1959, but no subsequent construction has been reported. 16/ Extensive reconstruction and expansion are planned for the Alma-Ata Heavy Machine Building Plant, but, because of insufficient allocation of investment funds, work has lagged on new projects, including two new machine bays, casting facilities, and a boiler room. 17/

Investment is planned at other plants of the industry, but information is not available concerning specific measures to strengthen capabilities for production of metallurgical equipment or related components. One program of particular importance is that for expanding capacities of electric furnace building plants, including those at Novosibirsk and Saratov. 18/

Some capacity may be provided by utilization of other suitable machine building plants for production of metallurgical equipment. One measure of this type is the apparent reactivation of the Izhora plant near Leningrad as a producer of rolling mill equipment. One of the oldest heavy machine building plants in the USSR, the Izhora plant is not known to have produced significant quantities of metallurgical equipment in the past 15 years. The plant is now engaged in the manufacture of a large 600-millimeter (mm) structural mill with technical equipment weighing 17,000 tons. 19/

D. Improvements in Methods of Production

Improvements in methods and techniques of production constitute an integral part of investment programs at major equipment plants. One

important objective is improvement of foundry operations, including wider use of mechanized techniques. The Elektrostal' plant was one of the first plants in the USSR to introduce (in 1959) a mechanized continuous flow line for production of large casting molds by means of a sandslinger on a small-series basis. 20/ At Uralmash, where steel foundry facilities are being expanded, extensive use is planned of mechanized continuous flow production techniques by specializing production of steel castings in groups according to weight. Mechanized techniques are to be used in production of cores and molds, for shaking-out operations, and in the cleaning of castings. 21/

Another objective of Soviet producers of metallurgical equipment is better utilization of machine tools by improved scheduling of production. For example, the Elektrostal' plant has spent several years in classifying its parts and components according to similarities in configuration and production processes required. Several of the classified categories concern parts for rolling mills. 22/ One practical result of these efforts has been the establishment of sections for "group machining" of some of these parts, although the extent to which the technique is being used on parts for rolling mills is not known. 23/

Other improvements in methods of production are being effected as existing shops are reequipped and new ones constructed. Metals of higher quality are now available for the manufacture of equipment with the greater use of vacuum degassing and electroslag remelting and the installation of new electric furnaces in casting shops. Methods of heat treatment have been improved by the recent installation of new induction heating furnaces at Uralmash and the Novo-Kramatorsk plant. Increased use has been made of modern welding techniques for such applications as hard surfacing of parts of metallurgical equipment subject to intense wear, such as blast furnace bells; manufacture of welded ladles instead of heavier riveted models; and depositional buildup of worn rolls of rolling mills and repair of other types of metallurgical equipment. Especially important as a means of reducing requirements for large castings and forgings is the growing use of electroslag welding, a Soviet-developed technique, in the manufacture of large components such as housings for rolling mills. Completion of new welded structures shops at Uralmash and the South Ural plant will permit considerably increased use of this technique. Electroslag welding also has been used to reduce the time required for assembly and installation of blast furnace units.

E. Organization of Production

A long-established and much-discussed objective of the metallurgical equipment industry has been specialization in the manufacture of various types of metallurgical equipment. Some progress has been made in the establishment of specialized production responsibilities

among the major plants of the industry, particularly for the principal types of rolling mills. Uralmash has primary responsibility for the manufacture of cold rolling mills as well as blooming mills and plate mills. The Novo-Kramatorsk plant specializes in the manufacture of slabbing mills and continuous hot sheet and strip mills but also manufactures cold rolling and other types of mills. The Elektrostal' plant has been assigned primary responsibility for the manufacture of pipe and tube mills.

The USSR has been less successful in seeking to concentrate production responsibilities for the total production of metallurgical equipment in a smaller number of plants as a means of increasing both the efficiency and the volume of production. Certain sovnarkhozes continue to be criticized in the Soviet press for organizing production of metallurgical equipment in machine building plants of their economic regions. 24/ The assignment of production tasks to these plants, however, probably is explained by the inability of established plants to meet growing demands for metallurgical equipment and other types of heavy equipment for which they continue to be responsible.

A variety of proposals have been made to establish specialized machine building facilities for spare parts and replacement components. For example, the need has been cited for a specialized machinery plant in the Urals, similar to the Slavyansk Machinery Plant in the Ukraine, for the manufacture of spare parts, standard components, and specialized equipment for coke ovens. When made singly at local repair or machine shops, such items are expensive and often are of poor quality. 25/ Specialized production also has been proposed for such equipment items as replacement components for metallurgical cranes and delivery and exit guides for rolling mills. 26/ Such proposals are frequently advanced as a means of reducing the number of auxiliary workers in the steel industry. Establishment of an effective spare parts industry reportedly has been opposed, however, because of the high capital expenditures required. 27/ The same factor also may explain the lack of progress in establishing specialized production facilities for the various types of mechanical equipment needed in the program for mechanization and automation of Soviet steel plants.

IV. Production Plans

A. Aggregate Production

The USSR plans to produce 1,724,000 tons of metallurgical equipment during 1959-65, a substantial increase of 55 percent above the amount

produced during 1952-58. 28/* No official goal for 1965 has been established for metallurgical equipment, but the annual production of rolling mill equipment is scheduled to reach 200,000 to 220,000 tons. It is not clear how much rolling mill equipment the USSR has planned to produce during 1959-65. At a minimum, an increase of 53 percent above the amount produced in 1952-58 appears to have been planned -- or about 1 million tons, as cited in one document outlining plans for development of production of rolled steel. 29/ An increase of 75 percent is called for according to plans for the development of the metallurgical engineering branch of heavy industry. 30/ The larger increase would provide an aggregate production of 1,144,000 tons of rolling mill equipment during 1959-65. This total would represent 66 percent of the planned production of metallurgical equipment compared with 59 percent in 1952-58, which appears to be consistent with plans for increased emphasis on equipment needs of the rolling and finishing sector of the steel industry. The goals for increasing the physical volume of production during the plan period reflect aggregate requirements for both Soviet industry and export programs.

B. Requirements of the Soviet Steel Industry

Most of the metallurgical equipment produced by the USSR is used to satisfy domestic requirements. During 1957-60 the USSR devoted 72 percent of the domestic production of metallurgical equipment to its own steel industry, although on an annual basis the proportion ranged from 66 percent in 1958 to 82 percent in 1960. These data are indicative of the total volume used at home but do not reveal the varied equipment needs of the growing Soviet steel industry. Equipment is required not only for the construction of new, diversified capacity but also for the modernization and rebuilding of older, existing facilities. In addition, large quantities of materials-handling and auxiliary equipment are required for current programs of mechanization and automation in the Soviet steel industry.

Planned construction of new pig iron capacity during 1959-65 amounts to 24 million to 30 million tons. For this purpose, the USSR plans to build 31 blast furnaces, predominantly with working volumes of 1,700 and 2,000 cubic meters (cu m). 31/ Increased requirements for metallurgical coke are to be met mainly by construction of 53 new coke batteries. 32/

* Some of the metallurgical equipment produced by the USSR is for nonferrous metallurgy, but by far the larger share is for ferrous metallurgy, more specifically the steel industry, thus reflecting the considerable difference in scales of operation. In 1961, Soviet production of the principal nonferrous metals (aluminum, magnesium, copper, lead, zinc, and tin) was approximately 2 million tons, whereas production of crude steel amounted to 70.8 million tons.

During 1959-65 the USSR plans to construct 28 million to 36 million tons of new crude steel capacity. Open-hearth furnaces will continue to predominate in this new construction, although the relative share of production from these furnaces is expected to decrease. The relative share of converter steel is to be increased by construction of basic oxygen converters with capacities of 75, 100, and 250 tons. Twenty-five electric furnaces are to be built, some with capacities of 80 and 180 tons. 33/

In the case of new rolled steel capacity, the goal is 23 million to 29 million tons. During the plan period the USSR plans to put into operation 55 new hot rolling mills. Of this number, 13 are to be plate and sheet mills with an aggregate annual capacity of 21.6 million tons. 34/ Some of the types of mills that the USSR plans to have in operation by the end of 1965 are shown in Table 1.* Although the total number of these types of rolling mills is to be reduced during the plan period, the aggregate annual capacity will be considerably larger because of the higher productivity of new mills compared with older mills scheduled for retirement and the rebuilding of some older mills to larger capacities. In addition, perhaps a dozen or more blooming and slabbing mills are scheduled for installation during 1959-65. 35/ Eleven cold rolling mills are scheduled to be put into operation as well as heat-treatment facilities and continuous finishing line equipment, including continuous lines for pickling, galvanizing, and electrolytic tinning. 36/

The USSR plans to manufacture and put into operation about 30 mills for production of steel pipes with diameters from 20 to 1,020 mm and a considerable number of mills for cold rolling of pipe and tube products. 37/ Of particular importance are new mills required for production of large-diameter pipe for gas and oil pipeline programs. Heat-treatment facilities for pipe and tube products are to be considerably improved and expanded. 38/

By 1965 the USSR also plans to construct and have in operation continuous casting installations with an annual output of 8 million tons. 39/

Soviet plans for construction of new capacity encompass the subsidiary objective of permitting retirement of old and obsolete equipment. During 1959-65 the USSR plans to retire 21 blast furnaces with an aggregate annual capacity of 3 million tons 40/; 44 open-hearth furnaces with an aggregate annual capacity of more than 2 million tons 41/; and 91 rolling mills, including 52 plate and sheet mills. The rolling mills have an aggregate capacity of about 3 million tons, although the current annual production at these mills is about 2.4 million tons, including 1 million tons of sheet metal. 42/

* Table 1 follows on p. 15.

Table 1

USSR: Selected Types of Rolling Mills in Operation a/
1 January 1959 and Planned for 1 January 1966

Type of Rolling Mill	Mills in Operation 1 January 1959				Mills Planned to Be in Operation 1 January 1966			
	Total		Of Which: Modern Mills		Total		Of Which: Modern Mills	
	Number	1958 Production (Thousand Metric Tons)	Number	1958 Production (Thousand Metric Tons)	Number	Capacity (Thousand Metric Tons)	Number	Capacity (Thousand Metric Tons)
Pipe billet	3	1,269	2	1,026	3	1,850	2	1,335
Rail-structural	5	4,544	3	3,467	5	5,350	3	4,100
Strip (skelp)	3	932	2	830	4	2,420	3	2,250
Large bar	55	8,099	3	2,664	43	13,249	8	7,450
Medium bar	29	3,797	3	1,656	31	8,236	8	5,695
Small bar	36	3,670	4	1,460	36	7,722	11	5,150
Special section bars	0	0	0	0	3	172	3	172
Wire	16	2,932	3	1,260	19	6,225	11	5,025
Sheet	144	11,680	10	6,373	104	35,933	23	31,352

a. 43/

C. Export Requirements

Although the planned volume of exports during 1961-65 is not known, substantial amounts of equipment have been scheduled for delivery to the Bloc and underdeveloped countries (mainly India and Egypt). During 1957-60, exports amounted to 212,300 tons, or 28 percent of the domestic production of metallurgical equipment.*

V. Performance

A. Aggregate Production

In 1961 the USSR produced 213,900 tons of metallurgical equipment, a slight decline from the 218,300 tons produced in 1960. Production of rolling mill equipment, the largest subcategory, also declined from a level of 120,600 tons in 1960 to 102,100 tons, considerably below the plan of 150,000 tons. The decline in production in 1961, following gains in production achieved in 1959 and 1960, repeated a pattern prevalent in previous years of failure to maintain a steady rate of growth in production. Soviet production of metallurgical equipment and rolling mill equipment during 1950-61 and Seven Year Plan goals are given in Table 2.**

The increases in production during the first 2 years of the plan period -- for metallurgical equipment, 14 percent and 9 percent, respectively, in 1959 and 1960 and for rolling mill equipment, about 18 percent in both years -- permitted the industry to reach new peak levels. In the case of rolling mill equipment, however, the gains in production were less impressive in light of the fact that they had reversed a trend of steadily declining production in preceding years. It is noteworthy that the average production of rolling mill equipment during 1959-61 actually was not much higher than in the previous peak years of 1955 and 1956.

From the point of view of progress toward fulfillment of aggregate production goals for the plan period, the results obtained during 1959-61 were disappointing. In the case of metallurgical equipment the total production was 633,000 tons, or 37 percent of the total of 1,724,000 tons planned for 1959-65. To reach the planned total, the USSR must produce on the average 273,000 tons of metallurgical equipment every year during 1962-65.

In the case of rolling mill equipment the shortfall was even more considerable. The total production during 1959-61 was 325,300 tons, or 33 percent of the lower aggregate goal (1 million tons) planned for 1959-65,

* Factors related to the Soviet export program during 1961-65 are discussed in VI, p. 24, below.
** Table 2 follows on p. 17.

Table 2

USSR: Production of Metallurgical Equipment, by Type a/
1950-61 and Planned for 1959-65

Thousand Metric Tons

	Total Metallurgical Equipment	Rolling Mill Equipment	Other Metallurgical Equipment b/
1950	111.2	66.1	45.1
1951	109.7	64.2	45.5
1952	123.5	69.4	54.1
1953	145.7	87.5	58.2
1954	153.7	94.2	59.5
1955	172.1	108.5	63.6
1956	177.2 c/	111.3 c/	65.9
1957	167.2 c/	96.1 c/	71.1
1958	176.1 d/	86.9 d/	89.2
1959	200.8 e/	102.6 e/	98.2
1960	218.3 e/	120.6 e/	97.7
1961	213.9 e/	102.1 e/	111.8
1965 Plan	N.A.	200.0 to 220.0 f/	N.A.
1952-58	1,115.5	653.9	461.6
1959-65 Plan	1,724.0 g/	1,000.0 to 1,144.0 h/	580.0 to 724.0

a. Unless otherwise indicated, source 44/.
b. Residual.
c. 45/
d. 46/
e. 47/
f. 48/
g. 49/
h. 50/

but only 28 percent of the higher goal (1,144,000 tons). To reach the lower goal for aggregate production, the USSR must achieve an average annual production of 169,000 tons every year during 1962-65. The higher goal would require an average annual production of 205,000 tons.

B. Trends in Equipment Design

1. General

The USSR manufactures metallurgical equipment of conventional, modern design. In blast furnace and open-hearth design the USSR leads the West in several respects, largely as a result of systematic adoption of both foreign and domestic technical innovations.* A major accomplishment of the metallurgical equipment industry, as described below, has been to provide mechanical equipment for blast furnaces and open-hearth furnaces as well as coke ovens that rank among the largest in the world. On the other hand, the USSR has lagged in designing and constructing large-capacity electric furnaces and basic oxygen converters. The USSR manufactures large, complex rolling mills, but, for the most part, follows developments in the West in the basic designing of this equipment.

2. Coke Batteries

The USSR is a leader in the trend toward coke ovens of large capacity. In 1959 the USSR introduced a new 77-oven coke battery with ovens 30 cu m in volume compared with 20.0 and 21.6 cu m for older Soviet models and about 22.0 cu m for the normal oven in use in the US. 51/ The new battery has an annual capacity of more than 650,000 tons. 52/ New batteries with ovens 36 to 40 cu m in volume are in the planning stage. 53/

3. Blast Furnaces

During 1959-61 the USSR constructed blast furnaces with volumes of 1,719 and 2,000 cu m to continue the Soviet trend toward large-capacity blast furnaces. The 2,000-cu m furnaces, which are the largest in the world, have estimated annual capacities of 1.1 million tons based on current operating practices.** As a result of Soviet progress in the

* It should be stressed that many of the advances in iron and steelmaking are the result of technical innovations, such as the use of auxiliary fuels and high top pressure in blast furnace operations and the use of oxygen and improved refractories in steelmaking. Although the metallurgical equipment industry provides basic mechanical equipment needed in metallurgical production units as well as auxiliary equipment for mechanization of related materials-handling processes, various other industries provide equipment for the intensification of metallurgical processes, including compressors, oxygen-generating facilities, and refractories.

** High productivity achieved by these and other Soviet blast furnaces reflects progress in equipping blast furnaces and auxiliaries to permit extensive use of modern operating practices, including careful preparation of the charge, high top pressure, high blast temperature, oxygen in the blast, natural gas as an auxiliary fuel, and controlled moisture content. Development work has been undertaken, as it has in the US, on computer control of blast furnace processes.

construction of large blast furnaces in recent years, the average size of Soviet blast furnaces is now approximately equal to the average US furnace. 54/

4. Open-Hearth Furnaces

The USSR is currently constructing open-hearth furnaces with capacities of 500 to 600 tons that rank with the largest in use in the world. A 900-ton open-hearth furnace is under construction. 55/

5. Basic Oxygen Converters

The USSR is behind schedule in its basic oxygen steelmaking program. The only oxygen converters currently in operation are those of comparatively small capacity -- up to 55 tons -- installed before the Seven Year Plan. Work has started on the manufacture of equipment for new converters of 100-ton capacity, which are scheduled to be in operation in 1963.* 56/ Design work was to be undertaken in 1962 on larger units of 250-ton capacity. 57/ In the US, where the basic oxygen steelmaking process is gaining rapid acceptance, a 272-ton converter was put into operation late in 1962. 58/

6. Electric Furnaces

The largest electric furnaces in operation in the USSR have rated capacities of 80 tons, although heats of 90 to 100 tons have been made. The first unit of this size was put into operation in 1959. 59/ Designing of a 180-ton furnace was undertaken as early as 1956, but it is not scheduled to be in operation before 1965. 60/ In the US, electric furnaces capable of outputs of 180 tons or more have been used for a number of years. 61/

7. Continuous Casting

The USSR, which first began research on continuous casting in 1944, has constructed facilities for commercial scale as well as experimental operations. The process was designed to permit direct casting of billets and slabs to eliminate both the pouring of ingots and the subsequent use of breakdown mills (blooming and slabbing mills). However, the process is still in the development stage in the USSR. Existing units were reported to have produced 450,000 tons of steel in 1960. 62/ Considerable developmental work has been accomplished in other countries, primarily in Western Europe, and the number of

* The USSR also has lagged in the construction of oxygen-generating facilities required by the trend toward increased use of oxygen in steelmaking, not only in new basic oxygen converters but also in open-hearth steelmaking.

commercial installations is increasing. 63/ In the US, although some small-capacity units have been built and operated, the process has not been adopted commercially, because of uncertainty about the ability to achieve the large tonnages required for efficient operations. A number of producers in the US are showing increased interest in recent developments, however, and two companies have ordered full-scale, continuous casting machines to make large steel slabs. 64/

8. Rolling Mills and Finishing Equipment

Rolling mills built by the USSR during the current plan period conform generally to modern standards for speed of rolling, weight of starting material, and use of continuous arrangements in rolling and related production processes. As a result, capacities of new Soviet mills compare favorably with those of similar mills in the West. For example, 1,150-mm blooming mills constructed by the USSR reportedly are capable of annual outputs of 3 million tons. Several 1,300-mm blooming mills, described as fully automatic with annual capacities of 6 million tons, are scheduled to be put into operation during the plan period. 65/ The new 850/700/500-mm continuous billet mill was designed for an annual output of more than 3 million tons. 66/ Available information indicates a similar trend toward large capacities for other Soviet mills, such as wire, rod, and bar mills. The USSR also has manufactured continuous wide strip mills with outputs planned as high as 3.5 million tons. 67/

On the other hand, many of the larger mills, particularly multistand mills, require long lead times for design, construction, and installation. For example, a highly productive 650-mm rail-structural mill was put under construction in 1952 and required extensive revision of original equipment components before being put into operation in 1959. 68/ Each of the three continuous wide strip mills put into operation in 1960 required 5 years or more for completion. In general, long lead times for large mills frequently result in a failure to incorporate improved design features, necessitating modification or rebuilding in order to attain desired levels of output and operating efficiency. Difficulties currently are being encountered in designing and manufacturing cold rolling mills. Only one continuous-type mill, a 5-stand, 4-high, 1,200-mm cold strip mill, was completed during 1959-61. Two other continuous-type mills scheduled for 1961 were not completed. The lag in constructing these and other types of cold rolling mills also has slowed work on development of modern types of finishing and processing equipment, such as continuous lines for pickling, annealing, electrolytic tinning, and galvanizing. Some of these modern types of finishing equipment currently are being manufactured for the first time in the USSR.

9. Pipe Mill Equipment

In the expansion of the Soviet pipe and tube industry, predominant importance is attached to the design and manufacture of pipe and tube welding mills. 69/ Seamless mills, which accounted for 59 percent of the total production of steel pipes in 1958, are still being manufactured but in comparatively smaller numbers. For example, a continuous mill for production of seamless tubes up to 102 mm in diameter was put into operation early in 1962. Equipment for this modern mill, which appears similar in design to US mills, consists mainly of a 9-stand mandrel mill, a 19-stand reduction mill, and a sizing mill. 70/

The Soviet trend toward welding mills is explained by factors similar to those that already have led to greatly increased use of these mills in the West: comparative simplicity of equipment requirements and hence lower capital costs, lower operating costs, and ability to produce thin-walled pipes and tubes of accurate dimensions. Among mills of this type installed during the plan period are a 102-mm electroweld mill, an 820-mm electroweld mill, and a 1,020-mm electroweld mill. The USSR also has constructed a spiral weld mill capable of producing pipe up to 720 mm in diameter. Recently, another mill of this type began production of pipe up to 1,020 mm in diameter. 71/ A mobile spiral weld unit also has been developed for direct use in the field where pipe is being laid. 72/

Difficulties have been encountered, however, in designing, manufacturing, and installing some of these mills. Reported design and equipment defects apparently explain the failure of the first Soviet electroweld mill to reach planned levels of output for production of badly needed large-diameter pipe up to 1,020 mm in diameter. 73/ Work on a second mill of this type apparently is considerably behind schedule. 74/ The USSR also is lagging in the manufacture of other types of pipe mill equipment, particularly heat-treating furnaces and modern finishing equipment, such as pipe-cutting and pipe-threading machines, boring and polishing machines, and protective coating equipment. 75/

10. Equipment for Mechanization Programs

Although new basic units (blast furnaces, open-hearth furnaces, and rolling mills) constructed by the USSR generally are characterized by a high degree of mechanization in keeping with their high output capabilities, programs for mechanization throughout the steel industry are behind schedule. 76/ Perhaps the most progress has been made in the case of coking operations. Technical publications indicate that a high level of mechanization has been attained in this area with the exception of repair operations. 77/ One well-placed Soviet expert has stated that the level of mechanization in coking operations is the highest of all the segments of Soviet ferrous metallurgy. 78/ More progress has been made

in mechanization of blast-furnace and steelmaking operations than in rolling and finishing operations, but, in general, production of many planned types of mechanization equipment has lagged or has not been organized. An indication of current trends, however, is given by enumeration of some new types of equipment now being produced or under development. Of the specialized equipment that the USSR plans to adopt for blast furnace operations, several types are in wide use in the West. Examples include ore-averaging equipment, charge spreaders, vibrating screens for sifting coke fines, and large-capacity pig iron carts. 79/ For the mechanization of handling operations in steel shops the USSR is designing and producing new materials-handling units with enlarged capacities and increased durability such as charging machines, casting cranes, and pig iron conveying ladles. 80/ Considerable attention also is being given to the development of equipment for the mechanization of auxiliary operations in steel shops. In particular, machines are being developed for the preparation and treatment of scrap, furnace maintenance and repair, flushing and removal of slag, preparation of ingot molds, opening and closing of tapholes, and repair of ladles. 81/ Deficiencies in steel rolling and finishing operations, which current programs are intended to remedy, are the inadequate levels of mechanization of older rolling mills and the general lag in adoption of mechanization techniques in auxiliary operations, such as cutting, straightening, coil winding, stacking, and marking. 82/

C. Significance of Shortfall in Production

The lag in production of metallurgical equipment is one reason for failure to meet schedules for commissioning new iron and steel capacity. During 1959-61 the USSR commissioned 8.2 million tons of blast furnace capacity, 12.3 million tons of crude steel capacity, and 10.9 million tons of rolled steel capacity. 83/ Carryover projects completed in the first quarter of 1962 provided 2.2 million additional tons of blast furnace capacity and 1.4 million tons of crude steel capacity. At the end of the first quarter of 1962, however, commissioning of new capacity was short of that planned for 1959-61 by the following estimated amounts: blast furnace capacity, 1.1 million tons; crude steel capacity, 1.0 million tons; and rolled steel capacity, as much as 1.5 million tons. 84/

Delays in commissioning new capacity, however, have not seriously affected the planned growth in the total production of iron and steel and are unlikely to do so in 1962-65 unless additional problems are encountered. Such delays have been offset by success in obtaining substantially increased production from existing facilities. On the other hand, shortfalls in production of equipment that delay the commissioning of new capacity may adversely affect plans for retirement of obsolete and inefficient equipment. Moreover, continued lags in production of special types

of metallurgical equipment may affect programs for improving the variety and quality of steel mill products, particularly cold rolled products, and for mechanization and modernization of the steel industry. As discussed above, the USSR has encountered difficulty in manufacturing certain types of equipment in adequate numbers and variety, including cold rolling mills, finishing line equipment (such as continuous lines for galvanizing and electrolytic tinning), pipe mill equipment, heat-treating furnaces for steel mill products (including tubular products), and various types of equipment for mechanization and automation programs.

D. Problems

One reason for the failure to achieve the planned production of metallurgical equipment is the lack of sufficient machine building capacity available for this purpose. Delays on the part of major equipment producers as well as suppliers of materials and components in meeting scheduled delivery dates frequently are caused by heavy demands on these plants for other types of industrial equipment as well as metallurgical equipment. Such demands may explain, in part, the absolute drop in production of rolling mill equipment in 1961 as well as in 1957-58.

Results obtained during the first half of the current plan period indicate that investment in major plants of the metallurgical equipment industry is behind schedule. Also, little progress has been made in establishing specialized plants for production of equipment needed for mechanization programs in the steel industry. 85/ Completion of expansion projects currently underway at major plants may be expected to alleviate existing problems, but evidence exists that Soviet planners are concerned about the adequacy of these projects to keep pace with long-range equipment requirements of the steel industry. Various proposals have been advanced for the construction of new metallurgical machine building facilities, among them new facilities in eastern areas to serve new steel centers. 86/

Planning and designing difficulties also help explain failure to meet schedules for production of desired quantities and types of equipment. For example, the lag in undertaking the task of equipping new basic oxygen steelmaking shops appears to be the result not only of delays in solving technical and design problems but also of indecision in the steel industry as well as at Gosplan and other planning and technical levels. Negotiations conducted since 1960 with Austria to obtain L-D converter equipment and technology have reflected the lack of satisfactory progress in the domestic oxygen converter program.

Similar difficulties have been encountered in planning expansion in other segments of the steel industry, particularly in the adoption of modern types of rolling and finishing facilities. As a result, the various

plants of the metallurgical equipment industry frequently do not have well-defined production plans. For example, the important Uralmash Plant has been cited in the Soviet press as having neither a long-range plan nor a stable plan for the immediate years ahead for production of rolling mill equipment. 87/ Scheduling of production at the plant level also has been affected adversely by delays in translating basic designs into detailed blueprints and other working drawings. In addition, both the scheduling and the execution of production of equipment frequently have been disrupted by ineffective coordination of related supply and construction tasks. These inefficiencies in mobilizing and utilizing industrial resources frequently have resulted in protracted delays in completing major projects. As discussed above, lead times for design, construction, and installation of large, multistand rolling mills have been as high as 5 and even 10 years compared with 2 and perhaps 3 years in the US.

VI. Foreign Trade

A. Exports, 1955-61*

The USSR is the leading exporter of metallurgical equipment in the Sino-Soviet Bloc. Although it imports substantial amounts of metallurgical equipment, the USSR has been a net exporter since 1955.** The size of the export balance has varied considerably, however, as shown by comparative data given in Table 3 on the volume (expressed in tons) of exports and imports during 1955-61. The decline in Soviet exports in 1960 resulted from the completion of several major projects, mainly in China and in India.

Most of the metallurgical equipment exported by the USSR is rolling mill equipment. In 1959 and 1960, such exports represented 89 percent and 94 percent, respectively, of all exports of metallurgical equipment. During 1955-58, for which period complete data are not available, the proportion of rolling mill exports may have been somewhat lower but probably no lower than 75 percent.

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* Although complete data are available concerning the volume of Soviet imports of metallurgical equipment in 1961, only partial data are available for exports, as shown in Table 3 (which follows on p. 25).

** Only fragmentary data are available for the period before 1955. However, the USSR may have been a net importer during a few of these years. Although equipment assistance was provided to Bloc countries, the generally lower level of domestic production during those years probably did not permit as high a level of exports as that since 1955. On the other hand, imports of equipment (in the form of reparations deliveries) from East Germany, the major source of imports during those years, may have been higher than in subsequent years.

Table 3

USSR: Exports and Imports of Metallurgical Equipment and Rolling Mill Equipment a/ 1955-61

Thousand Metric Tons

	1955	1956	1957	1958	1959	1960	1961
Exports							
Metallurgical equipment	42.2	N.A.	52.9	60.3	59.2	39.9	9.6 b/
Of which:							
Rolling mill equipment	6.9 b/	5.4 b/	5.9 b/	6.3 b/	52.7	37.4	9.5 b/
Imports							
Metallurgical equipment	35.2	26.4	33.7	27.4	21.3	24.6	26.7
Of which:							
Rolling mill equipment	33.3	26.1	32.7	26.3	20.9	24.2	26.1
Export balance							
Metallurgical equipment	7.0	N.A.	19.2	32.9	37.9	15.3	N.A.
Rolling mill equipment	N.A.	N.A.	N.A.	N.A.	31.8	13.2	N.A.

a. 88/

b. Representing only explicit shipments of equipment. Data are not available for shipments of equipment as part of complete enterprises, which make up the larger share of exports.

The principal recipients of Soviet exports of rolling mill equipment have been Bloc countries. Several of these countries produce rolling mill equipment but not in adequate quantity or variety to meet the needs of their steel industries. The USSR, the largest Bloc producer of rolling mill equipment, has been the principal supplier of this equipment, particularly the larger and more complex mills that other Bloc countries do not have the capability to manufacture. Examples include the modern hot and cold sheet and strip mills needed to expand production of flat rolled products.*

Soviet shipments to the Bloc of rolling mills and other types of metallurgical equipment have been particularly important in the construction of new steel plants and expansion of major existing plants. Soviet equipment sent to Communist China during the 1950's contributed substantially to the buildup of capacity of large plants at An-shan, Wu-han, Pao-t'ou, and several other locations. 89/ Poland received 130,000 tons of Soviet equipment during 1945-60, most of which went to the Lenin Metallurgical Plant in Nowa Huta. 90/ Other important metallurgical plants in the Bloc that have received substantial amounts of equipment from the USSR include the Lenin Metallurgical Plant in Dimitrovo, Bulgaria 91/; the Hunedoara Metallurgical Combine in Rumania 92/; and the Danube Metallurgical Combine in Dunaujvaros (formerly Sztalinvaros), Hungary. 93/ Czechoslovakia has received a considerable amount of Soviet metallurgical equipment, mainly rolling mill equipment, for several major plants. 94/

The USSR also has exported metallurgical equipment to several underdeveloped countries, including Egypt and India. The latter has received substantial amounts of equipment for construction at Bhilai of an integrated steel plant with a capacity of 1 million tons of crude steel. The major items of equipment installed at Bhilai were a blooming mill, a continuous billet mill, a rail-structural mill, a merchant mill, and equipment for three coke batteries, three blast furnaces with volumes of 1,033 cu m each, and six open-hearth furnaces with capacities of 250 tons each. 95/

B. Imports, 1955-61

Most of the metallurgical equipment imported by the USSR consists of rolling mill equipment (see Table 3**). During 1955-61, imports of rolling mill equipment accounted for 97 percent of the total weight of all metallurgical equipment imported by the USSR, helping to offset, at least in part, the substantial volume of Soviet exports of this equipment.

* For a list of mills of this type that the USSR has built or is scheduled to build for Bloc countries, see Appendix B.
** P. 25, above.

The principal suppliers of rolling mill equipment are East Germany and Czechoslovakia. During the period 1955-61, these two countries accounted for more than 90 percent of the total Soviet imports of rolling equipment, as shown in Table 4.

Table 4

USSR: Imports of Rolling Mill Equipment
1955-61

Thousand Metric Tons

	1955	1956	1957	1958	1959	1960	1961
Total	33.3	26.1	32.7	26.3	20.9	24.2	26.1
Of which:							
Czechoslovakia	6.9	3.2	10.4	9.5	8.6	9.5	13.1
East Germany	26.4	22.9	21.7	14.6	9.2	12.6	11.5
Czechoslovakia and East Germany as a percent of total	100	100	98	92	85	91	94

East Germany has provided the USSR with wire-drawing equipment, small bar mills, tube mill equipment, and a wide variety of auxiliary equipment and components for rolling mills, such as shears, levelers, roller tables, gears, and spindles. 96/ Equipment recently obtained from Czechoslovakia includes a continuous billet mill, much of the equipment for a 1,120-mm blooming mill, and various types of auxiliary equipment for rolling mills. 97/

Imports from the West have made up only a small part of the total Soviet imports of metallurgical equipment. Imports of rolling mill equipment from the West have not included complete rolling mill assemblies, only auxiliary equipment. Austria has provided auxiliary rolling mill equipment and rolls for rolling mills as well as small amounts of steel smelting equipment. 98/ France and West Germany also have provided small amounts of auxiliary rolling mill equipment. 99/

C. Trends, 1961-65

Although the planned volume of Soviet exports of metallurgical equipment during 1961-65 is not known, the USSR probably will continue

to export substantial amounts of this equipment, mainly to the Bloc. Czechoslovakia is scheduled to receive equipment for its new metallurgical plant in East Slovakia, including a slabbing mill, a 1,700-mm continuous hot strip mill, and a 1,280-mm tandem cold sheet mill. 100/ Planned shipments to Bulgaria include much of the equipment for the new metallurgical plant to be built at Kremikovtsi. 101/ Rumania is scheduled to receive a semicontinuous hot sheet mill for its new plant at Galati. 102/ Poland will receive equipment for the Lenin Metallurgical Plant and other plants, including two slabbing mills, a pipe rolling mill, and a continuous cold rolling mill. 103/ Planned shipments to East Germany are not definitely known, but they may include a continuous hot strip mill and a cold sheet mill. 104/ The USSR also plans to provide equipment to North Korea, particularly for the Kimchaek Iron and Steel Works. 105/ In the case of China, aggregate shipments of equipment are not likely to be as large as those during 1955-60. Deliveries were completed in 1961 of equipment for a few outstanding projects, including a rail-structural mill and a seamless tube mill, 106/ but only comparatively small amounts of equipment are known to be scheduled during 1962-65.

In addition, the USSR plans to provide metallurgical equipment to underdeveloped countries, mainly India and Egypt. India is to receive Soviet assistance for expanding crude steel capacity at the Bhilai Metallurgical Plant from 1.0 million to 2.5 million tons. 107/ Egypt is scheduled to receive from the USSR rolling mill equipment valued at 33 million rubles,* including a slabbing mill, a sheet mill, and cold strip mills. 108/ Smaller amounts of equipment are scheduled for shipment to Indonesia and Cuba. 109/

On the other hand, two recent trends appear likely to modify the pattern of trade prevailing during 1955-60. In the first place, several Bloc countries are becoming more important as producers and suppliers of rolling mill equipment.** Although the position of the USSR as the principal Bloc supplier of this equipment, particularly the larger and more complex rolling mills, is unlikely to change, the trend toward increased activity by these Bloc countries may be expected to reduce dependence on the USSR for some types of rolling mills. In addition, the USSR is scheduled to increase its imports from Bloc countries of those types of rolling mill equipment within their productive capacities. From the point of view of the USSR, these developments have the advantage of

* In new rubles as established by the Soviet currency reform of 1 January 1961. A nominal rate of exchange based on the gold content of the respective currencies is 0.90 ruble to US $1. This rate, however, should not be interpreted as a precise ruble-dollar relationship that will yield an equivalent dollar value.

** For a brief account of these changes, see Appendix C.

enabling Soviet machine building plants to devote greater attention to other required types of equipment.

The second significant trend is the growing interest of the Bloc in obtaining equipment from the West, suggesting that the gradual strengthening of Bloc capabilities, as mentioned above, is not sufficient to keep pace with growing requirements for metallurgical equipment. Moreover, some of the types sought from the West are those that the USSR has not produced in sufficient quantities for its own needs. Significant quantities of equipment, including pipe mill equipment and finishing facilities, already have been obtained by the European Satellites from Western manufacturers of equipment. For example, Poland, which to date has been the principal recipient of Western equipment, has obtained a seamless pipe mill from West Germany 110/; a hot dip tinning installation from the UK 111/; and a considerable quantity of finishing equipment from the US, including a continuous galvanizing line (installed in 1961), an electrolytic tinning line (to be put into operation in 1963), and various specialized auxiliary installations. 112/

In addition, most Bloc countries have made extensive inquiries and apparently have placed a considerable number of new orders with Western manufacturers of equipment. For example, East Germany is scheduled to receive from West Germany during 1962-64 two pipe-welding installations; a cold sheet mill; a rod mill; cold drawing facilities for tubes, bars, and wire; and auxiliary equipment for heat treatment and vacuum casting. 113/ East Germany also has ordered tube rolling and drawing facilities from France for delivery during 1962-64. 114/ Rumania reportedly has ordered a considerable amount of rolling mill equipment from West Germany, including a continuous billet mill, two merchant mills, and a continuous rod mill. 115/ Rumania also has placed an order with a Franco-British consortium for a plate mill. 116/ Considerable interest also has been shown by Poland, Czechoslovakia, Bulgaria, and Hungary in obtaining equipment from the West. The full extent of negotiations and order-placing is not clear, but available evidence indicates a trend of growing reliance by the Bloc on the West for an important share of its new rolling and finishing facilities.

The USSR, confronted with a lag in its own domestic converter program, has engaged in protracted negotiations since 1960 with Austria for acquisition of L-D oxygen converter equipment and technology. The negotiations also are of interest to the European Satellites, some of which have negotiated independently -- and so far unsuccessfully -- with the L-D firm, as the USSR has agreed to provide assistance to them in constructing new oxygen converter shops.

APPENDIX A

USSR: LOCATIONS AND PRINCIPAL PRODUCTS OF THE MAJOR PLANTS OF THE METALLURGICAL EQUIPMENT INDUSTRY

1. Alma-Ata Heavy Machine Building Plant (AZTM)
   Location: Alma-Ata
   Principal products: Wire-drawing and tube-drawing mills; equipment for coke batteries, blast furnaces, and rolling mills.

2. Dnepropetrovsk Metallurgical Equipment Plant (DZMO)
   Location: Dnepropetrovsk
   Principal products: Equipment for coke batteries, blast furnaces, open-hearth furnaces, and electric furnaces; components for continuous casting installations and rolling mills; auxiliary equipment such as machines for baling scrap and cleaning and servicing open-hearth furnaces (probably the widest range of individual types of metallurgical equipment of any plant in the industry).

3. Elektrostal' Heavy Machine Building Plant (EZTM)
   Location: Elektrostal'
   Principal products: Pipe and tube mills, structural and bar mills, liquid friction bearings for rolling mills.

4. Irkutsk Heavy Machine Building Plant (IZTM)
   Location: Irkutsk
   Principal products: Equipment for blast furnaces and open-hearth furnaces and for wire-drawing and tube-drawing mills; components and auxiliary units for rolling mills.

5. Novo-Kramatorsk Heavy Machine Building Plant (NKMZ)
   Location: Kramatorsk
   Principal products: Hot strip mills, slabbing mills, and cold wide strip mills; large-capacity cranes and ladles for steel casting shops; mixers and shears.

6. Staro-Kramatorsk Heavy Machine Building Plant (SKMZ)
   Location: Kramatorsk
   Principal products: Cold narrow strip mills, including multiroll (Sendzimir-type) cold rolling mills; auxiliary equipment for processing strip and sheet, such as levelers, shears, trimming lines, and sheet stackers; auxiliary equipment for pipe mills.

7. South Ural Heavy Machine Building Plant (YuZTM)
   Location: Orsk
   Principal products: Equipment for coke batteries and blast furnaces, steel-pouring ladles, continuous casting installations, blooming mills, billet mills.

8. Ural Heavy Machine Building Plant imeni Ordzhonikidze (Uralmash or UZTM)
   Location: Sverdlovsk
   Principal products: Blast furnace equipment, blooming mills, billet mills, plate mills, rail and structural mills, cold rolling mills, pipe and tube rolling mills, wheel rolling mills.

APPENDIX B

MODERN HOT AND COLD STEEL SHEET AND STRIP MILLS BUILT (OR TO BE BUILT) BY THE USSR FOR BLOC COUNTRIES 1955-65

1. 1,700-mm continuous hot sheet mill
   Location: Kosice, Czechoslovakia
   Remarks: Scheduled to go into operation in 1964. The Novo Kramatorsk Heavy Machine Building Plant is to provide the mechanical equipment. Czechoslovakia is to provide the necessary electrical equipment.

2. 1,280-mm, 5-stand, 4-high tandem cold sheet mill
   Location: Kosice, Czechoslovakia
   Remarks: Scheduled to go into operation in 1963. The Uralmash plant is building the mill. Part of the equipment has been shipped.

3. 1,700-mm, 10-stand, 4-high continuous hot sheet mill
   Location: Nowa Huta, Poland
   Remarks: Put into operation in 1955. Built by the Novo Kramatorsk Heavy Machine Building Plant.

4. 1,700-mm, 5-stand, 4-high tandem cold sheet mill
   Location: Nowa Huta, Poland
   Remarks: Put into operation in 1958. Probably built by the Uralmash plant.

5. 1,500-mm hot sheet mill
   Location: Dunaujvaros, Hungary
   Remarks: Put into operation in 1960. Built by the Novo Kramatorsk Heavy Machine Building Plant.

6. 1,500-mm cold sheet mill
   Location: Dunaujvaros, Hungary
   Remarks: Expected to be in operation in 1963. Being built by the Uralmash plant.

7. 1,200-mm continuous hot strip mill
   Location: Eisenhuettenstadt, East Germany
   Remarks: The USSR may provide equipment for a mill of this type, which East Germany unsuccessfully sought to obtain from a US firm. 117/

8. Cold sheet mill
   Location: Eisenhuettenstadt, East Germany
   Remarks: Similar to 7, above.

9. Semicontinuous hot strip mill
   Location: Galati, Rumania
   Remarks: One of the most important mills planned for the new steel plant at Galati.

10. 2,800/1,700-mm semicontinuous hot sheet mill
    Location: An-shan, China
    Remarks: 2,800-mm plate mill built by the Uralmash plant and put into operation in 1958. The 1,700-mm, 6-stand sheet mill was built by the Novo Kramatorsk Heavy Machine Building Plant and put into operation in 1959.

11. 1,700/1,200-mm cold rolling mill
    Location: An-shan, China
    Remarks: Built by the Uralmash plant and put into operation in 1961.

12. 2,300/1,700-mm hot sheet mill
    Location: T'ai-yuan, China
    Remarks: Built by the Novo Kramatorsk Heavy Machine Building Plant. Delivery of equipment is believed to have been completed early in 1960, and the mill may have gone into operation later that year.

13. 2,800-mm plate mill
    Location: Wu-han, China
    Remarks: The Uralmash plant was shipping equipment in 1959, and the mill may have been put into operation in 1961.

APPENDIX C

EXPORTS OF ROLLING MILL EQUIPMENT BY THE EUROPEAN SATELLITES

A. Exports, 1955-60

Apart from the USSR, only Czechoslovakia and East Germany exported rolling mill equipment in substantial quantities during 1955-60. Czechoslovakia, the second most important Bloc producer of rolling mill equipment, normally exports more than one-half of its domestic production of this equipment. 118/ In 1960, Czechoslovakia produced 34,900 tons of rolling mill equipment compared with 23,700 tons in 1959 and 10,200 tons in 1956. 119/ Of the 120,100 tons of this equipment produced by Czechoslovakia during 1955-60, the USSR received 40 percent, or about 75 percent of all exports. 120/ North Korea has been the principal recipient of the remaining Czechoslovak exports of rolling mill equipment, and smaller amounts have been received by Poland, East Germany, China, and Egypt. 121/ Among the principal types of rolling mills manufactured by Czechoslovakia for both domestic and export markets are blooming mills; continuous billet mills; large bar mills; continuous mills for production of rod, wire, and narrow strip; and pipe and tube mills, mainly for small-diameter products. On the other hand, Czechoslovakia has not undertaken the manufacture of continuous wide strip mills or continuous-type cold rolling mills.

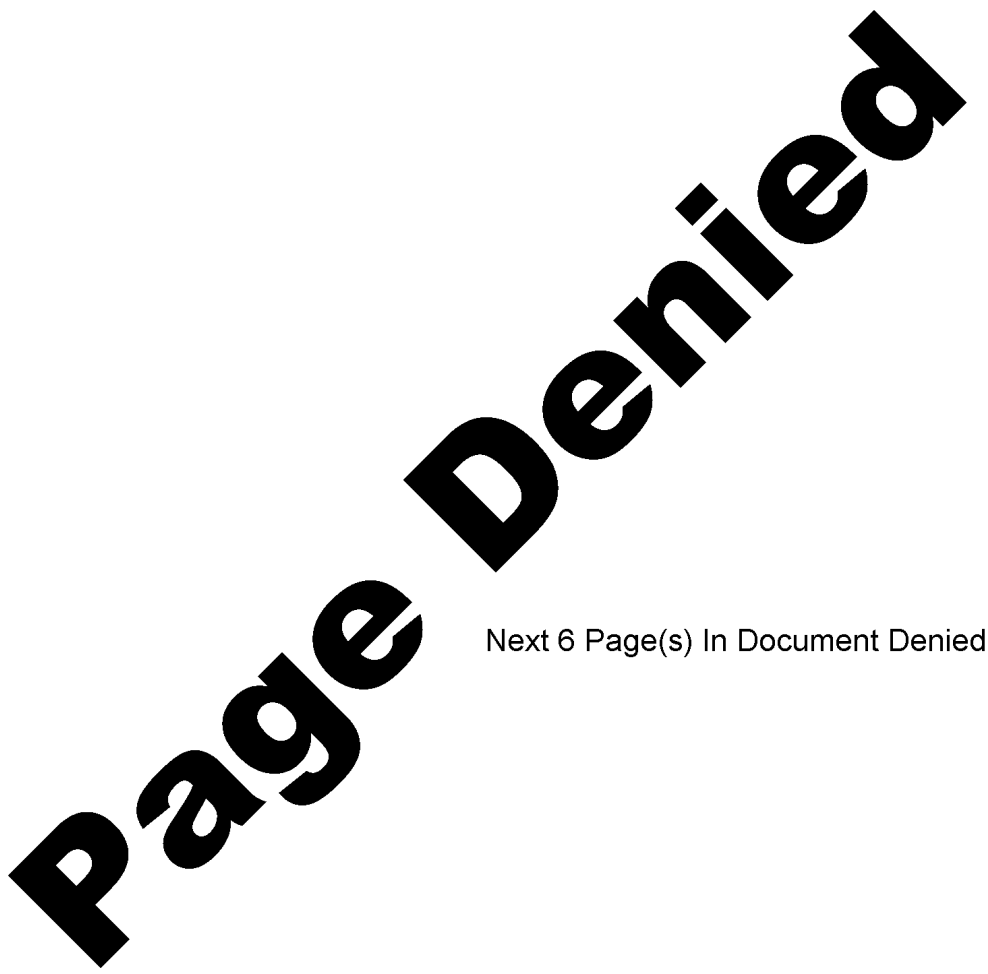
East Germany formerly ranked ahead of Czechoslovakia in annual output of rolling mill equipment but in recent years has fallen behind. Whereas Czechoslovakia has considerably increased its production of rolling mill equipment, East German production has declined. In 1960, East Germany produced 15,900 tons of this equipment compared with 27,800 tons in 1956. 122/ Most of the rolling mill equipment produced by East Germany has been for export, primarily to the USSR. The USSR, in fact, received 90 percent of the 118,400 tons of rolling mill equipment produced by East Germany during 1955-60. 123/ The principal types manufactured by East Germany are small bar mills, wire drawing equipment, pipe mill equipment, small sheet and cold rolling mills, and a wide variety of auxiliary equipment.

During 1955-60, only comparatively small amounts of rolling mill equipment were exported by other Bloc countries. Hungary has exported pipe and tube mill equipment, 124/ and Poland has exported components for rolling mills, including rolls, reduction gears, and pinion stands.

B. Trends, 1961-65

In 1961, Czechoslovakia produced 60,500 tons of rolling mill equipment -- not only substantially more than the 34,900 tons produced in 1960 but also only slightly below the goal of 66,700 tons for 1965. 125/ Continued production at this level in 1962-65 probably would make feasible fulfillment of the plan to provide the USSR with 115,000 tons of rolling mill equipment during 1961-65. 126/ Shipments to the USSR during the preceding 5-year period amounted to 41,200 tons.

Several other Bloc countries plan to increase exports of rolling mill equipment. East Germany is scheduled to step up its exports of rolling mill equipment to its principal customer, the USSR, during 1961-65. 127/ Hungary, which already has shipped pipe mill equipment to Ch'eng-tu in China, has started delivery of additional equipment for another pipe plant in China. 128/ Hungary also is expected to provide equipment for the overhaul of several pipe and tube plants in the USSR and Czechoslovakia 129/ and may provide new pipe mill installations to other Bloc countries and possibly non-Bloc countries. 130/ Poland began to export significant quantities of rolling mill equipment in 1961 and apparently plans to increase exports through 1965. Polish exports in 1961 included a small bar mill to India, 131/ machinery for the manufacture of wheels and axles to Yugoslavia, 132/ and part of the equipment for a billet mill to East Germany. 133/ Delivery of the remainder of the equipment for this billet mill was to have been made in 1962, and equipment for a plate mill also is to be provided to East Germany by 1964. 134/ Poland also plans to ship additional rolling mill equipment to India and Yugoslavia, and negotiations with several other non-Bloc countries may result in additional orders for rolling mill equipment. 135/ Moreover, as part payment for the substantial amounts of equipment to be imported from the USSR, Poland has undertaken to provide that country with metallurgical equipment within its productive capacity. 136/



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