UNITED STATES TARIFF COMMISSION

SUMMARIES OF TRADE AND TARIFF INFORMATION

Prepared in Terms of the Tariff Schedules of the United States (TSUS)

Schedule 6

Metals and Metal Products
(In 11 volumes)

Volume 4

Iron and Steel

TC Publication 221
Washington, D.C.
1967

SUMMARIES OF TRADE AND TARIFF INFORMATION BY SCHEDULES

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F O R E W O R D

In an address delivered before a Boston audience on May 18, 1917, Frank W. Taussig, the distinguished first chairman of the Tariff Commission, delineated the responsibility of the recently established Commission to operate as a source of objective factual information on all aspects of domestic production and trade. As an initial step in meeting this obligation, the chairman stated, the Commission was preparing--

> a handy source of reference . . . designed to have on hand, in compact and simple form, all available data on the growth, development, and location of industries affected by the tariff, on the extent of domestic production, on the extent of imports, on the conditions of competition between domestic and foreign products.

The first such report was issued in 1920, and subsequent general issues of tariff summaries were published in 1921, 1929, and 1948-50.

In the 50 years since its establishment the Commission has been assigned many duties by the Congress, but the primary obligation for factfinding and production of information has remained a continuous major responsibility. Through its professional staff of commodity specialists, economists, lawyers, statisticians, and accountants, the Commission maintains constant surveillance of trade in the thousands of articles provided for in the Tariff Schedules of the United States. In its files and in the accumulated knowledge of its staff, the Commission has, therefore, built up a large reservoir of data and understanding not only with respect to imports but also with regard to significant developments affecting individual products and their uses and to processing and manufacturing techniques, business practices, and world trade. The publication of the present Summaries of Trade and Tariff Information will make available a current broad cross section of this information and understanding.

Every effort has been made to include all pertinent information in the summaries so that they will meet the needs of wide and varied interests that include the Congress, the courts, Government agencies, importers, business concerns, trade associations, research organizations, and many others. The structure of the individual summaries conforms generally with the earlier admonition of Chairman Taussig that the work "be exhaustive in inquiry, and at the same time brief and discriminating in statement." The scope of the entire project is encyclopedic, requiring concise and accurate descriptions of thousands of products, with indications of their uses, methods of production, number of producers, world supplies, and appraisals of their importance in trade and in our economy. In a society such as ours that has become progressively more dynamic, the task of sifting the essential from the nonessential has become both more difficult and more

important. Nevertheless, the summaries include substantive analytical material with regard to the basic factors affecting trends in consumption, production, and trade, and those bearing on the competitive position and economic health of domestic industries.

The publication of tariff summaries is particularly appropriate at this time. On August 31, 1963, the 16 schedules in titles I and II of the Tariff Act of 1930, certain import-excise provisions, other provisions of law, and some administrative practices were superseded by the Tariff Schedules of the United States (abbreviated to TSUS of these volumes). These changes resulted in an extensive regrouping of imports under 8 new tariff schedules and in modifications of the nomenclature and rates of duty for many articles. The summaries present for the first time full information on tariff items under the new structure, including import data derived through use of the Tariff Schedules of the United States Annotated (which comprises the legal tariff text plus statistical annotations).

Commodities are generally identified in the summaries in nontechnical language, which will meet most requirements. As an aid where more complete information is desired, the applicable legal language from the TSUS is reproduced in each volume as appendix A, which includes the article description, together with the general headnotes and rules of interpretation, and the directly applicable headnotes. Thus each volume will permit convenient reference to the statutory tariff language pertinent to the summaries it contains.

Publication of the 62 volumes projected for the series is scheduled under a program requiring several years for completion. Individual volumes, however, will be released as rapidly as they are prepared. For practical reasons the sequence of the summaries in the volumes does not necessarily follow the numerical sequence of the TSUS; however, all item numbers of the tariff schedules will be covered. The titles of the volumes to be issued for a particular TSUS schedule are set forth on the inside cover of the volumes for that schedule.

The Commission believes that the current series of summaries, when completed, will represent the most comprehensive publication of its kind and that the benchmark information it presents will serve the needs of many interests.

SUMMARIES OF TRADE AND TARIFF INFORMATION

SCHEDULE 6

Volume 4

C O N T E N T S

Numerical List of TSUS Items in This Volume

Numerical List of TSUS Items in This Volume

INTRODUCTION

This volume, identified as volume 6:4, covers the iron-bearing materials provided for in part 1 of schedule 6 of the Tariff Schedules of the United States (TSUS) and the products of iron or steel (except spiegeleisen and ferroalloys) that are provided for in subpart 2B of that schedule. Also included here are the pipes and tubes suitable for use as electrical conduits, and the fittings therefor, that are provided for in part 5 of schedule 6.

Iron ore and ferrous scale are virtually the only iron-bearing materials of commerce included in part 1 of schedule 6; iron-bearing chemical compounds, pigments, and fertilizers are provided for in schedule 4 of the TSUS. The iron or steel products in subpart 2B include iron or steel waste and scrap, pig iron, iron or steel powders (including chemically pure iron), and virtually all the basic shapes and forms of iron or steel. In brief, the summaries in this volume discuss the iron-bearing raw materials used in blast furnaces to produce pig iron; the pig iron and iron or steel scrap used in steel furnaces to produce raw steel; and certain steel-mill products manufactured by rolling, drawing, extruding, or forging. (See accompanying flow chart on steelmaking.)

The interpretive headnotes to subpart 2B, which clarify the relationships between the various tariff items providing for the products of iron or steel covered in this volume and define the terms used in the classification descriptions, are reproduced in appendix A and are discussed in the general statement beginning on page 23. Also included in the general statement is a discussion of the four alloying elements--chromium, molybdenum, tungsten, and vanadium--that are the basis for the additional cumulative import duties applicable to certain products of alloy iron or steel under the provisions of items 607.01 to 607.04.

U.S. Bureau of the Census data for 1965 indicate that manufacturing activity in the iron or steel products discussed in this volume, which involved about 800,000 production and related workers, accounted for roughly $14 billion in value added by manufacture and $29 billion in value of products shipped, or 74 percent of value added and 65 percent of value of shipments, by all the industries that constitute Major Group 33 of the Standard Industrial Classification. Among the 21 Major Groups of manufacturing industries for which data are reported, Major Group 33 ranked sixth in 1965 in terms of value added and third in terms of shipments.

The United States, the world's leading producer of iron or steel products, currently accounts for about a fourth of the total output of raw steel. In the period 1962-66, annual U.S. production of raw steel rose by 36 percent, and world output rose by an estimated 30 percent. In the same period, production in the U.S.S.R., the second largest steel-producing nation, increased by 27 percent, while the much smaller output in Japan, which became the third-ranking producer in 1965,

increased by 73 percent, and the combined production of the member countries of the European Economic Community (EEC) 1/ increased by 17 percent.

Technological advances in methods of producing iron and steel and in techniques for fabricating mill products have contributed significantly to the rise in world output of raw steel in recent years. Use of the basic-oxygen process--whereby a heat (batch) of steel can be produced in 1 hour or less compared with an average of about 8 hours for the open-hearth method--has recently become significant in the United States. The share of domestic output produced by the basic-oxygen process rose from 6 percent in 1962 to 25 percent in 1966 and is expected to reach 35 to 45 percent of the total by 1970, despite the improvements being made in the open-hearth process. At the beginning of 1966, the United States possessed an estimated 30 percent of the world capacity for producing basic-oxygen steel. Other significant developments in steelmaking include the continuous-casting method of producing steel--whereby the ingot and primary rolling stages are eliminated--and vacuum degassing processes--whereby the internal structure of steel (and therefore its strength) is improved. Currently only about 1 or 2 percent of the U.S. output of raw steel is being produced by the continuous-casting process, but additions to continuous-casting capacity are under construction. Moreover, increased use of vacuum degassing processes is expected to result in further advances in the quality of alloy steels produced. As a consequence of increasing production of steels having a higher strength-to-weight ratio, a growing number of consumers can use less steel than formerly to get the strength required in a particular application.

In 1966, U.S. imports of iron ore, which amounted to 46 million long tons, valued at $462 million, constituted about 35 percent of steel producers' requirements and were larger than the iron ore imports of any other country. Steel producers in some other major steel-producing countries are even more dependent than U.S. producers on imports of iron ore. Japan's steel producers, for example, rely almost entirely on imports for their requirements of iron ore.

The United States is also the world's leading importer of many steel-mill products. In 1966, aggregate imports of the products included here (except iron ore) were valued at $1.2 billion dollars. Plates, sheets, and strip combined accounted for about 42 percent of the total value of these 1966 imports; pipes and tubes (except those for ball or roller bearings), 12 percent; angles, shapes, sections, and sheet piling, 11 percent; bars (including deformed reinforcing bars), 10 percent; wire rods, 9 percent; and wire, 7 percent. In 1966, imports of plates, sheets, and strip (4.8 million short tons) were equivalent to

1/ Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany.

7 percent of the domestic output. For the other iron or steel products mentioned above, the corresponding import tonnages and ratios of imports to domestic output were as follows: Pipes and tubes (1.1 million tons), 11 percent; angles, shapes, sections, and sheet piling (1.5 million tons), 18 percent; deformed reinforcing bars (0.7 million tons), 18 percent; other bars (0.6 million tons), 6 percent; wire rods (1.2 million tons), 22 percent; and wire (0.5 million tons), 7 percent. The 1966 imports of ingots, blooms, billets, slabs, and sheet bars amounted to 0.2 million tons, valued at $35 million, and were equivalent to about 0.2 percent of the domestic raw steel output.

Japan, the principal source of U.S. imports of steel-mill products in recent years, supplied 51 percent of the value of the 1966 imports of sheets, plates, and strip and about 45 percent of the value of all the 1966 imports included in this volume. Canada, the EEC, the United Kingdom, and Sweden are also important foreign suppliers of the products considered here. Canada is usually the source of nearly all the imports of ingots, blooms, billets, slabs, and sheet bars, a significant portion of which are entered duty free under bond for processing and export (principally to Canada).

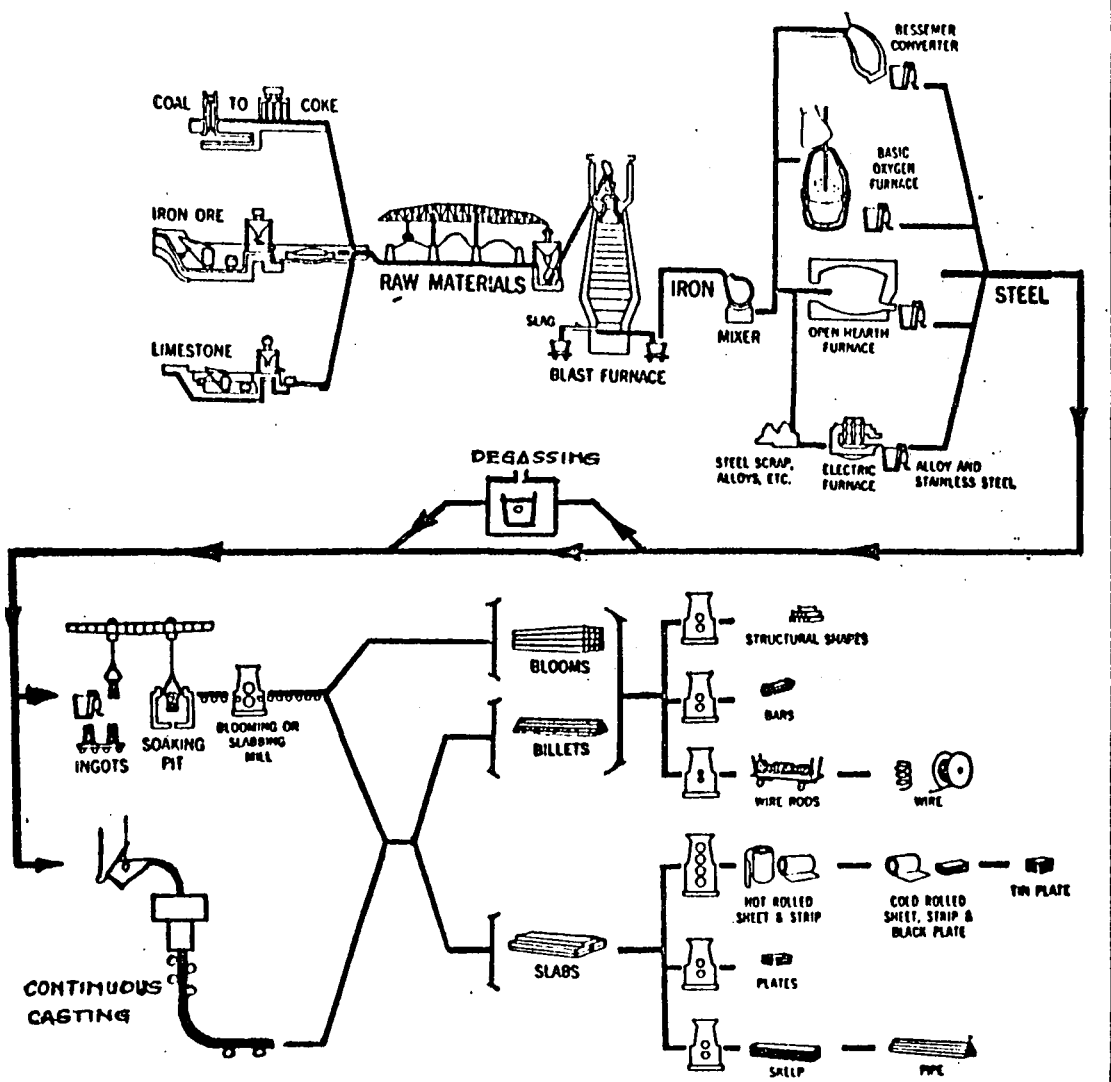
In appendix A to this volume, the TSUS items on which the United States granted concessions in the tariff negotiations concluded on June 30, 1967--commonly referred to as the Kennedy Round--are identified by a number sign (#), and the final stage rates are listed on page 289. Under the Trade Expansion Act of 1962 (76 Stat. 872), which gave the President authority to reduce duties by 50 percent of the rate existing on July 1, 1962, most U.S. concessions involving reduction in duty must be placed in effect in five stages. After the first stage becomes effective--expected to be on January 1, 1968--the subsequent stages will go into effect at annual intervals. In 1966, the imports of the products included in this volume on which concessions were granted were valued at $758 million and were dutiable at rates which averaged about 9 percent ad valorem. If the duty on these 1966 imports had been assessed on the basis of the final stage rates rather than the current rates, the total amount of the duty would have been reduced by about 17 percent.

In 1966, U.S. exports of the iron or steel products covered here were valued at about $500 million, an amount about $1,200 million less than the aggregate value of the corresponding imports. In terms of value, about two-fifths of the exports in 1966 consisted of plates, sheets, and strip, and about three-eighths were pipes, tubes, and fittings (principally pipes and tubes other than for ball or roller bearings).

In recent years, Canada has been the largest and most consistent U.S. export market for steel-mill products. A significant part of the exports to other markets, which include nearly every country in the

free world, have been attributable to programs of the U.S. Government. Expenditures by the U.S. Agency for International Development for procurement of iron or steel products (including some not covered here) from U.S. sources totaled about $168 million in 1965 and $90 million in 1966.

Flow Chart of Steelmaking



Source: Adapted from chart published by American Iron and Steel Institute.

Commodity	TSUS item
Iron ore, including manganiferous iron ore containing not over 10 percent by weight of manganese, and the dross or residuum from burnt pyrites	601.24

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume).

U.S. trade position

The United States--the free world's largest consumer, producer, and importer of iron ore--depends on imports to meet about a third of its requirements. During the last decade, the demands of the domestic iron and steel industry for increasing quantities of high quality ores have encouraged large investments at home and abroad for development of ore bodies and construction of ore-processing plants.

Description and uses

Iron ore, as provided for under item 601.24, may be crude (as mined), concentrated by physical or mechanical means as long as such processing has not resulted in substantial chemical change, or roasted or sintered. Iron ore containing more than 10 percent by weight of manganese, however, is provided for in item 601.27 and is discussed in a separate summary in volume 6:2.

Iron ore is used almost exclusively in the production of iron and steel. More than 99 percent of the iron ore consumed in the United States is used in blast furnaces for the production of pig iron or in steel furnaces. The remainder is consumed in ferroalloy furnaces; in the manufacture of paint pigments, cement, and high-density concrete; and as a heavy medium in coal-processing plants.

Also provided for under item 601.24 is the iron-bearing material known as dross or residuum from burnt pyrites or pyrites cinder. Such material is the residue from burning iron pyrite (a sulfide of iron) in the manufacture of sulfuric acid. Pyrites cinder, which has the same uses as iron ore, is of minor commercial importance.

Iron ores are valued chiefly for the recoverable iron they contain. The most common iron minerals in commercial iron ore deposits are the oxides of iron, particularly hematite, magnetite, and limonite (or brown ore). Hematite, the most abundant of these minerals, has an iron content of about 70 percent by weight. Magnetite, with an

iron content of about 72 percent, is attracted by a magnet--a characteristic that is utilized in prospecting for iron ore and in separating magnetite from waste material. Limonite includes a group of natural hydrous iron oxides having substantial moisture and ranging in iron content from 52 to 66 percent. Because of the presence of gangue (waste) materials, the iron content of commercial ores in their natural state is less than indicated above. Iron also occurs in nature in the form of carbonates, silicates, and sulfides, but these minerals probably account for less than 1 percent of the iron minerals used.

Magnetic taconite is a hard granitelike rock that contains magnetite in finely dispersed particles. It rarely contains more than 30 percent iron by weight, but it is fast becoming an important source of iron in the United States, which has large deposits of magnetic taconite minable by open pit methods.

During the last several years magnetite has grown increasingly important in terms of production of both crude and usable ore, 1/ but hematite has continued to be the predominant source of iron. Factors contributing to the growing importance of magnetite are depletion of the high-grade ores minable by open pit methods, development of new techniques for processing low-grade magnetic ores, and improvements in stripping, digging, and transporting ore. The importance of open pit mining, the chief method by which iron ore is produced, has increased. In general, underground mining is economically feasible only for deposits of high grades of iron ore.

An increasing proportion of the iron ore mined is treated to remove unwanted material or moisture and to improve its physical characteristics. Simple crushing and screening (sizing) are widely used for preparing usable ores for shipment to consumers. Iron ores are commonly concentrated by washing, jigging, heavy-media separation, flotation, and magnetic separation. Magnetic taconite is first crushed and then ground fine enough to pass through a 100-mesh screen. The fine powder is then passed over magnetic separators, which recover more than 95 percent of the magnetic iron content of the crude ore. The resulting concentrate may contain as much as 65 percent iron, compared with the 25- to 30-percent iron content of the crude ore. As nonmagnetic taconites are far more abundant in the earth's crust than magnetic, there are currently numerous research projects, including pilot plants, directed toward perfecting a concentrating process for this type of material. Research is also being done on conversion of

1/ Usable ore consists of direct-shipping ores (i.e., ores shipped as mined without preparation except, perhaps, crushing and screening), treated ores known as concentrates and agglomerates (as described in following paragraphs), and residuum from burnt pyrites (called by-product ore in the official statistics of the U.S. Bureau of Mines).

hematite to an artificial magnetite by means of controlled roasting; magnetite particles could then be recovered by magnetic separation.

To produce an acceptable charge for the blast furnace, fine ore particles (about one-fourth inch or less in diameter) are almost always separated from coarser material and agglomerated by a sintering process that forms larger hardened masses by heat without thorough melting. Agglomerated products reduce the iron loss that results when finer particles are literally blown away by the blast furnace draft; they also permit a more uniform furnace draft, which results in more orderly reduction of the iron ore. Magnetic taconite, the concentrates produced by flotation, most of the ores concentrated by other means, and the fines screened from direct-shipping ores are usually agglomerated. To facilitate the forming and firing processes, binders are generally used, and coal or coke, a flux (usually limestone), or both, may also be added. During sintering, the coke burns, but the flux is embodied in the agglomerate and provides an excellent burden for increasing blast-furnace efficiency. In producing agglomerates at steel mills in recent years, substantial quantities of ferrous scale (see following summary in this volume) have been mixed with the iron concentrates. Taconite concentrates and other iron concentrates are agglomerated at or near the mines, whereas large tonnages of high-grade direct-shipping ores of both domestic and foreign origin are agglomerated at the point of consumption, i.e., the iron and steel mills.

The most familiar forms of agglomerated iron ore are cinderlike, porous cakes of random shape (known in the industry as sinter), small marblelike spheres (pellets), larger and less uniform spheres (nodules), and small pillow-shaped masses (briquets). Pellets are by far the most important form agglomerated at or near the mines, whereas sinter is the predominant form at the mills. In the formation of pellets, iron ore fines are rolled into small spheres, which are then hardened by baking in a sintering or shaft furnace. The cost of specially preparing ores by these methods is offset by the higher iron content per ton of agglomerated product, the high yield and quality of hot metal obtained therefrom, the reduced requirements for limestone and coke per ton of metal output, and other economies in blast-furnace operations.

In this summary, all quantities are expressed in terms of long tons (2,240 pounds).

U.S. tariff treatment

Imports of iron ore (including manganiferous iron ore containing not over 10 percent by weight of manganese) and the dross or residuum from burnt pyrites are entered free of duty under item 601.24 of the TSUS. The duty-free treatment of iron ore, which was also provided

for under paragraph 1700 of the former tariff schedules, has been bound since January 1, 1948, in concessions granted by the United States in the General Agreement on Tariffs and Trade (GATT); it was also bound in the supplemental bilateral agreement with Venezuela, effective October 12, 1952. The duty-free status for dross or residuum from burnt pyrites, also provided for under paragraph 1700 of the former schedules, was bound in a GATT concession, effective June 6, 1951.

An embargo on U.S. imports from Southern Rhodesia of iron ore and certain other products, as well as products made from such Rhodesian products, was proclaimed by the President on January 7, 1967, in Executive Order 11322 (32 F.R. 119).

Effective December 7, 1965, Public Law 89-241 amended the definition of "metal-bearing ores" in headnote 2(a) to part 1 of schedule 6, specifically to insure that roasted or sintered iron ore would be admitted free of duty, as it had been under the former tariff provision for iron ore.

In response to a resolution of the U.S. Senate Committee on Finance, adopted July 29, 1958, the Tariff Commission instituted an investigation under section 332 of the Tariff Act of 1930 to determine the conditions of competition in the United States between domestic and imported iron ores. 1/

Pursuant to a subsequent resolution of that Senate Committee, adopted June 30, 1960, the Tariff Commission undertook an investigation under the authority of section 7 of the Trade Agreements Extention Act of 1951, as amended, to determine whether iron ore was, as a result in whole or in part of the customs treatment reflecting concessions granted thereon under trade agreements, being imported into the United States in such increased quantities, either actual or relative, as to cause or threaten serious injury to the domestic industry producing like or directly competitive products. As a result of its investigation the Commission made no recommendation to the President for the imposition of import restrictions. 2/

Under the authority of the Trade Expansion Act of 1962, the Commission, on May 3, 1963, instituted an investigation in response to a workers' petition for determination of eligibility to apply for adjustment assistance. The petition was filed on behalf on a group of workers from iron ore mines at Red Mountain, near Fairfield, Ala.

1/ U.S. Tariff Commission, Iron Ore: Report on Investigation No. 35 Under Section 332, Tariff Act of 1930 . . ., 1959 (processed).
2/ U.S. Tariff Commission, Iron Ore: Report on Escape-Clause Investigation No. 7-92 . . ., 1960 (processed).

On the basis of its investigation the Commission unanimously found that iron ore was not, as a result in major part of trade-agreement concessions, being imported in such increased quantities as to cause unemployment of a significant number or proportion of the workers from the mines in question. 1/

U.S. consumption

Except during periods of business recession and extended labor disputes in the iron and steel industry, consumption of iron ore in the United States has for many years trended upward. Consumption of iron ore in the United States in 1958 amounted to about 94 million tons, which, because of the recession in that year, was lower than consumption in any of the years 1950-57. Annual consumption ranged between 96 million and 113 million tons during 1959-63 and amounted to 132 million tons in both 1964 and 1965 and 134 million tons in 1966 (table 1).

The geographic distribution of the consumption of iron ore (including agglomerates) is of course directly related to the location and size of consuming plants. Data reported by the U.S. Department of the Interior show the following geographic pattern of consumption in 1965:

Geographic area	Quantity	Percent of total
	1,000 long tons	
New York, Ohio, and Pennsylvania	61,018	46.3
Illinois and Indiana	27,540	20.9
Maryland and West Virginia	11,407	8.6
Michigan and Minnesota	10,714	8.1
Alabama, Kentucky, and Texas	12,102	9.2
California, Colorado, and Utah	8,115	6.2
Other States	993	.7
Total	131,888	100.0

Iron and steel plants in the Southeastern States are increasingly substituting the substantially higher grade imported ores principally from South America, but also from Canada, for domestic ores from nearby

1/ U.S. Tariff Commission, Tariff Commission Reports to the President on Iron-Ore Mine Workers' Petition for Adjustment Assistance (TEA-W-3), TC Publication 96, 1963 (processed).

deposits. At least two east coast plants, one of which is the free world's largest single consumer of iron ore, operate exclusively on imported ores. Steel plants in the Midwest consume imported ores as well as ores produced in the Lake Superior region, whereas the steel plants in the West depend almost entirely on domestic ores from Utah, Wyoming, Colorado, and California.

Average blast-furnace consumption of usable iron ore per ton of pig iron produced declined from 1.74 tons in 1950 to 1.60 tons in 1958 and to 1.54 tons in 1966, reflecting the increasingly higher iron content of the usable ores. The average iron content of usable domestic ore increased from about 49 percent in 1950 to 53 percent in 1958 and to 57 percent in 1964-66, whereas the iron content of imported ores since 1950 has ranged as high as 69 percent, with an average of about 60 percent. In 1966 about two-thirds of the iron ore consumed in the United States from both domestic and foreign sources was in agglomerated form, principally sinter.

U.S. producers

By far the largest part of the domestic iron ore operations are controlled by domestic iron and steel producers. The remainder are principally in the hands of iron ore merchants that own or operate ore properties (sometimes in conjunction with a major steel producer) and sell ore in the open market but do not use ore themselves. Some iron ore producers are small, independently owned and operated concerns that sell ore in the open market.

The major steel companies generally own or control iron ore mines and concentrating plants, capable of producing three-fourths to four-fifths of their normal annual requirements; some of their iron ore properties are abroad. Consequently, these steel companies rely on the independent ore producers for only a small part of their iron ore needs. In periods of slack demand the integrated steel producers tend to reduce their open-market purchases in favor of maintaining--insofar as possible--the efficient, profitable, and continuous operation of their own ore mines; hence, they are less vulnerable in a declining market than the ore merchants and independent operators.

According to the U.S. Bureau of Mines, about 180 U.S. mines were engaged in the production of iron ore in 1965. The 10 largest mines accounted for well over 50 percent of the total crude ore produced in 1963, the latest year for which data are available, but only about 45 percent of the total usable ore. Notwithstanding the increase in annual production of crude ore in the United States since 1961, there has been a decline in the number of active mines. Producers unable to furnish iron ore or concentrates comparable in analysis and physical makeup to taconite pellets and high-grade imported ore are finding it

increasingly difficult to market their production. During 1964-66 the high operating levels of the steel industry sustained many small independent producers, particularly in the Lake Superior area, that could not afford the initial cost of constructing a large concentrating and agglomerating plant. It appears that in the years ahead an even larger proportion of annual iron ore output than in the past is likely to come from larger--or "captive"--operations.

U.S. production

Although the tonnage of usable ore produced in 1965 and 1966 (table 1) appears large in relation to that produced in other recent years, annual production in 1947-57 was generally larger. The usable ore produced in each of the years 1964-66, however, had an average iron content (57 percent) which was higher than that in any previous year. The ratio of the quantity of usable ore produced to that of crude ore declined from 84 percent in 1946 to 48 percent in 1963; concurrently there was a steep decline in the ratio of direct-shipping ore to crude ore and a sharp increase in the ratio of iron ore pellets (containing 62 to 65 percent iron) to usable ore, as indicated in the following tabulation for the years 1946, 1950, and 1958-66:

Year	Ratio (percent) of--		
	Usable ore to crude ore	Direct-shipping ore to crude ore	Pellets 1/ to usable ore
1946	84.1	64.2	2/
1950	78.0	55.9	2/
1958	61.7	33.0	13.6
1959	58.8	29.2	15.2
1960	57.3	25.2	16.1
1961	52.2	19.0	21.8
1962	50.1	15.4	26.3
1963	48.2	9.9	32.1
1964	49.8	12.5	33.1
1965	49.4	10.9	36.0
1966	49.4	10.7	39.9

1/ Including nodules and briquets.
2/ Not available; assumed to be very small.

The increasing dependence of iron ore consumers on concentrates, particularly the highly processed taconite ores, is further illustrated

by the following data on iron ore mining and concentrating operations in Minnesota in 1957 and 1966: 1/

Type of ore	1957		1966	
	Quantity	Percent of total	Quantity	Percent of total
	1,000 long tons		1,000 long tons	
Concentrated by gravity:				
Washed	11,391	16.7	9,766	17.6
Jigged	400	.6	931	1.7
Hi-density	7,635	11.2	8,534	15.4
Other	4,640	6.8	1,430	2.6
Agglomerates:				
Taconite	6,347	9.3	21,679	39.2
Other	352	.5	141	.3
Total, concentrates and agglomerates	30,765	45.1	42,481	76.8
Direct-shipping ore	37,531	54.9	12,834	23.2
Total, all shipments	68,296	100.0	55,315	100.0

U.S. production of agglomerated products in 1966, including those produced at the point of consumption, amounted to about 84 million tons: 48 million tons of sinter and 36 million tons of pellets; production of agglomerates in the other forms was negligible. Further substantial increases in U.S. pellet production are anticipated; present and currently planned capacity for such production is well in excess of 50 million tons annually.

The Lake Superior iron ore district, which has historically supplied about 80 percent of the iron ore produced in the United States, accounted for 77 percent of the total crude ore mined and 76 percent of the usable ore produced in 1966. Widespread acceptance of highly prepared ores has converted open pit mining in the Lake Superior district from a seasonal to a virtually year-round operation. The extremely large expenditures for the construction and maintenance of concentrating and agglomerating facilities impel continuous utilization of such equipment. Concentrates and agglomerates produced during the period December-March are stockpiled until the Great Lakes are free of ice and shipments can be resumed, generally

1/ University of Minnesota, Mines Experiment Station, University of Minnesota Bulletin, Mining Directory Issues.

during April. Underground mines accounted for 18 percent of the crude ore production of the Lake Superior district in 1950, for an estimated 12 percent in 1958, and for only 5 to 6 percent in 1965 and 1966. Many such mines in that district have been closed in recent years; those currently in operation were mechanized and automated to a high degree in order to reduce costs.

Until 1957 the Southeastern States (Alabama and Georgia) comprised the second most important domestic source of iron ore, generally accounting for 9 to 12 percent of annual output of crude ore and 7 to 9 percent of that of usable ore. The declining iron content of the crude ore available there has resulted in increased reliance by local consumers on the readily available and substantially higher grade imported ores, principally from Venezuela. In 1966 Alabama and Georgia together supplied only 3 percent of the crude ore and 2 percent of the usable ore produced in the United States.

In 1966 the Northeastern district (New Jersey, New York, and Pennsylvania) produced about 6 percent of the crude ore and 5 percent of the usable ore, whereas the States west of the Mississippi (except Minnesota) produced about 13 percent of the crude ore and 16 percent of the usable ore. Annual production of high-grade usable iron ore in the latter district will undoubtedly increase substantially as a result of the recent developments of ore bodies and the construction of concentrating and pelletizing plants in Missouri, Wyoming, and California.

U.S. exports

Exports of iron ore increased from 3.4 million tons (5 percent of production) in 1958 to 6.8 million tons (9 percent) in 1963. Exports amounted to 7 million tons during each of the years 1964 and 1965 and to 8 million tons in 1966 (table 1).

Canada has long been the principal market for U.S. exports of iron ore, owing in some degree to the partial ownership by certain Canadian steel producers of a number of U.S. mining firms in the Lake Superior district and to reciprocal arrangements between mine-mill operators in the United States and Canada which contribute to the ore exports of both countries. Exports to Japan, the only other important foreign market for U.S. iron ore, consist primarily of high-grade pellets produced in California and shipped under long-term contracts.

U.S. imports

Until the mid 1940's the United States was largely self-sufficient in iron ore. Since then, annual imports of iron ore have increased significantly owing to (1) the increased demand for economic supplies of high-quality ore, (2) the marked depletion of the best grades of ore in the traditional domestic mining districts, (3) the installation of new iron and steel facilities on the eastern seaboard, and (4) the development of the St. Lawrence Seaway. During the period 1951-56, iron-ore properties in Venezuela, Canada, Liberia, and Peru were developed principally or entirely by U.S. iron and steel producers, and the bulk of the ore output has been shipped to iron and steel furnaces in the United States. U.S. imports in 1957 totaled 33.7 million tons, or about one-fourth of the ore consumed in the United States in that year. As shown in table 1 (which presents data on imports of iron ore for 1958-66), iron ore imports reached a new peak in 1959 (35.6 million tons), reflecting in part the intensive activity in iron and steel mills during the first half of the year in anticipation of a workers' strike. Nearly all U.S. iron mines and steel mills were closed during the latter part of 1959. Annual imports averaged almost 32 million tons during 1961-63. In the years 1964-66, when iron and steel production set successive records, the demand for high-quality iron ore resulted in steadily increasing imports. Imports in 1966 reached 46.3 million tons, equivalent to about 35 percent of U.S. consumption.

In recent years Canada and Venezuela have supplied the bulk of U.S. imports (table 2). Chile, Liberia, Brazil, and Peru have also been important sources. Of the ore imported during 1964-66, Canada provided abount 54 percent of the tonnage; Venezuela, 26 percent; Liberia, 7 percent; and Chile, 6 percent.

An increasing part of the imported ores, as of the domestic ores, are of concentrated or agglomerated grades (mostly pellets). In 1966 almost 60 percent of the imports from Canada consisted of such grades. The bulk of the imports from the other major sources are direct-shipping ores. The imported direct-shipping ore, like the domestic direct-shipping ore, is generally screened and graded by size at or near the mine; the finer material is then agglomerated (principally in the form of sinter) by the consumer before being used in blast or steel furnaces.

The foreign ore properties from which almost all of the imported ore comes are controlled by U.S. concerns, principally iron ore consumers. One large domestic consumer, through wholly owned subsidiaries, operates iron ore properties in Venezuela and Canada. Another operates properties in Chile, Venezuela, and Canada through wholly owned subsidiaries and also has some financial interest in other Canadian properties and in Liberian properties. Most of the other

foreign properties supplying ore to the United States are owned jointly by several concerns, and generally the shares of the annual production shipped to the consumer-owners are proportionate to the extent of their ownersiip. The ownership of the Wabush Mines project in Canada, for example, is divided among five consumers in the United States, two in Canada, two in West Germany, and one in Italy.

World production and trade

World production of iron ore is estimated to have risen from about 251 million tons in 1950 to 572 million in 1964, 608 million in 1965, and to 619 million in 1966. Table 3 shows world iron ore production, exports, and imports, by selected countries, for 1964.

Some major steel-producing countries, notably Japan, depend largely or almost exclusively on imported iron ore. Conversely, many countries that have little capacity for iron and steel production produce large quantities of iron ore, e.g., Venezuela and Liberia. In recent years about a third of total world production of iron ore and almost half of free-world production have been consumed outside the country of origin. Although iron ore is fairly well distributed throughout the world, no country imposes restrictions on its importation.

In Australia, recently found deposits of high-grade iron ore were under extensive exploration and development during 1965 and 1966. No fewer than 10 U.S. firms, together with Japanese and other foreign interests, have invested large sums there in the development of mines and the construction of pellet plants, transportation networks, and auxiliary facilities, including entire towns.

Table 1.--Iron ore: 1/ U.S. production, imports for consumption, exports of domestic merchandise, and consumption, 1958-66

(Quantity in thousands of long tons; value in thousands of dollars)

Year	Production	Imports	Exports	Reported consumption	Ratio (percent) of imports to consumption
	Quantity				
1958	68,095	27,547	3,439	93,615	29.5
1959	60,550	35,627	2,973	96,303	37.1
1960	89,291	34,584	5,236	105,842	32.8
1961	71,425	25,808	4,916	103,125	25.1
1962	71,829	33,435	5,898	101,999	32.8
1963	73,599	33,266	6,813	112,672	29.7
1964	84,836	42,416	6,963	132,356	32.0
1965	87,842	45,105	7,085	131,880	34.2
1966	2/ 90,147	46,259	7,779	2/ 134,067	34.5
	Value				
1958	3/	231,626	34,426	3/	3/
1959	3/	312,495	33,824	3/	3/
1960	3/	321,939	57,575	3/	3/
1961	3/	250,235	53,823	3/	3/
1962	3/	324,728	62,833	3/	3/
1963	3/	323,206	76,390	3/	3/
1964	3/	421,337	79,670	3/	3/
1965	3/	443,807	80,418	3/	3/
1966	3/	462,354	92,157	3/	3/

1/ Data include all forms of usable ore (direct-shipping ore, concentrates, agglomerates, and byproduct ore).
2/ Preliminary.
3/ Not available.

Source: Production and consumption compiled from official statistics of the U.S. Department of the Interior; imports and exports compiled from official statistics of the U.S. Department of Commerce.

Table 2.--Iron ore: U.S. imports for consumption, by principal sources, 1958, 1959, and 1964-66

Country	1958	1959	1964	1965	1966
	Quantity (1,000 long tons)				
Canada	8,292	13,464	24,867	23,757	23,941
Venezuela	12,180	13,542	9,954	12,273	12,592
Brazil	832	1,200	1,055	2,279	2,723
Liberia	838	1,106	2,873	2,813	3,306
Chile	3,257	3,591	2,712	2,660	2,268
Peru	1,674	2,236	580	957	1,043
All other	474	488	375	366	386
Total	27,547	35,627	42,416	45,105	46,259
	Value (1,000 dollars)				
Canada	77,338	128,960	274,548	264,378	273,308
Venezuela	87,976	104,346	79,207	97,925	102,040
Brazil	12,004	13,613	11,660	23,380	26,695
Liberia	7,092	10,981	20,297	19,978	24,196
Chile	25,876	27,815	24,220	23,252	19,810
Peru	16,785	21,358	6,646	10,350	11,281
All other	4,555	5,422	4,759	4,544	5,024
Total	231,626	312,495	421,337	443,807	462,354

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Iron ore: World production, exports, and imports, by selected countries, 1964

Country	Production	Exports	Imports	Ratio of-- Exports to production	Ratio of-- Imports to production
	1,000 long tons	1,000 long tons	1,000 long tons	Percent	Percent
United States	84,836	6,963	42,416	8	50
Canada	34,219	30,474	5,207	89	15
Brazil	16,694	9,576	1/	57	-
Chile	9,697	8,969	1/	92	-
Peru	6,425	5,123	1/	80	-
Venezuela	15,403	14,658	1/	95	-
United Kingdom	16,326	-	18,017	-	110
France	59,976	21,742	3,595	36	6
West Germany	11,430	285	35,115	2	307
Sweden	26,199	23,959	62	91	2/
Japan	2,517	-	29,352	-	1,166
Liberia	12,794	12,069	1/	94	-
Total	294,039	133,818	133,764	45	45
U.S.S.R. and mainland China 3/	179,953	22,295	1/	12	-
World total 3/	572,344	194,914	194,914	34	34

1/ Nil or negligible.
2/ Less than 0.5 percent.
3/ Partly estimated.

Source: U.S. Department of the Interior.

Commodity	TSUS item
Ferrous scale	603.15
Other iron-bearing materials (except iron ore)	603.70 (pt.)

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume).

U.S. trade position

Ferrous scale, which constitutes virtually all of the material covered by this summary, is a byproduct of steelmaking operations and is consumed for the most part in the same plant where it is generated. Annual U.S. production probably totals 2 to 5 million tons; exports and imports are insignificant.

Description and uses

Ferrous scale refers to the various oxides of iron that form on the surface of hot steel when it is exposed to air. Most scale forms during heating operations preparatory to rolling or other hot-working processes and during hot-rolling or forging operations. If allowed to remain on the steel during the various stages of processing, the scale would cause surface defects in the product, variations in thickness, accelerated wear of rolling or fabricating equipment, and poor bonding or non-union of metallic or nonmetallic coatings that may subsequently be applied. Scale is particularly objectionable in the production of flat-rolled products such as plate, sheet, and strip where high surface quality is generally desirable. Although much of the scale flakes off the surface during hot-working, elaborate equipment for both mechanical and chemical removal of scale is necessary. Some form of descaling is common to virtually all phases of steel processing--in association with breakdown mills, roughing mills, and finishing mills.

Scale, which contains from 70 to 75 percent iron, is collected and recharged into the blast furnace for the recovery of the iron or charged into steel furnaces to hasten the refining process. In recent years, a large portion of the scale generated at steel plants having iron-ore sintering facilities has been mixed with the iron ore, limestone, and coke prior to sintering (see preceding summary in this volume). This practice not only increases the iron content of the resulting agglomerates without introducing undesirable elements, but it also incorporates the scale into a form suitable for the blast furnace.

Ferrous scale is also used for making sponge iron and iron powders (see summary on item 608.02 to 608.08 in this volume).

The iron-bearing materials covered by item 603.70, if any, consist of materials that have been processed by means (other than roasting or sintering) involving substantial chemical change, except such materials as are chemically defined compounds or materials specifically provided for elsewhere in the tariff schedules. Other metal-bearing ores (e.g., manganese and nickel) and metal-bearing materials (such as those provided for in item 603.60) may also contain useful quantities of iron (see separate summaries in vols. 6:1, 6:2, and 6:3).

In this summary, all quantities are given in terms of long tons (2,240 pounds).

U.S. tariff treatment

The current column 1 rate of duty applicable to imports of ferrous scale and other iron-bearing materials (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
603.15	Ferrous scale	75¢ per ton
603.70 (pt.)	Other iron-bearing materials	15% ad val.

The rate applicable to ferrous scale has never been the subject of a trade-agreement concession and is the same as originally provided in paragraph 301 of the Tariff Act of 1930. Based on imports entered in 1966, the ad valorem equivalent of the rate of 75 cents per ton was 8.5 percent.

The 15-percent rate for the iron-bearing materials in item 603.70 is the same as the rate provided under paragraph 214 of the previous tariff schedules and reflects a concession granted by the United States in the General Agreement on Tariffs and Trade, effective January 1, 1948.

U.S. consumption

Available data on consumption of ferrous scale relate only to the scale used in the production of agglomerates. Consumption in agglomerates has increased steadily and significantly in recent years--from

634,000 tons in 1958 to 2.9 million tons in 1966--as shown by the following data compiled by the American Iron and Steel Institute:

	Tons		Tons
1958--------	633,641	1963--------	1,654,872
1959--------	852,656	1964--------	2,241,288
1960--------	961,179	1965--------	2,623,816
1961--------	1,097,423	1966--------	2,935,271
1962--------	1,299,277		

The amount of scale charged directly into blast and steel furnaces is not known but is believed to be significant.

U.S. production, exports, and imports

Ferrous scale is a byproduct of the heating and hot-working of iron or steel. The accumulation of ferrous scale is probably equivalent to 2 to 3 percent of the annual production of raw steel.

Exports of scale are not separately reported in official statistics but are believed to be very small.

Imports of ferrous scale, which enter from Canada, ranged between 2,000 and 3,000 tons a year during 1958-65 but amounted to 14,000 tons in 1966. The following data, compiled from official statistics of the U.S. Department of Commerce, show the quantity and value of these imports for the years 1958-66:

	Quantity (tons)	Value		Quantity (tons)	Value
1958--------	1,997	$26,611	1963-------	2,296	$29,021
1959--------	3,142	42,424	1964-------	2,166	28,493
1960--------	2,169	28,430	1965-------	3,127	35,133
1961--------	2,151	28,144	1966-------	14,100	123,996
1962--------	2,401	30,037			

Scale is not likely to be imported for use in agglomerates since most concerns that have agglomerating facilities utilize only the scale that is generated from their own heating and hot-working operations. Imported scale, therefore, is probably used for other purposes, such as in the production of sponge iron or iron and steel powders.

GENERAL STATEMENT ON THE PROVISIONS OF SUBPART 2B OF SCHEDULE 6

The terms relating to grade, form, or condition of the products provided for in subpart 2B of TSUS schedule 6 have the meanings assigned to them in the headnotes to part 2 and to that subpart; these headnotes are reproduced in appendix A to this volume. The terms pertinent to all the summaries composing the remainder of this volume are discussed here, whereas those relating to particular products are discussed in the appropriate summaries.

Subpart 2B, as stated in its headnote 1, covers iron and steel, their alloys, their so-called basic shapes and forms, and also iron or steel waste and scrap. Alloys, as defined in headnote 2 to part 2, are "metallic substances consisting of two or more metals, or of one or more metals and one or more non-metals, intimately united, usually by having been fused together . . . but do not include substances in which the total weight of the metals does not equal or exceed the total weight of the non-metal components." With respect to the alloys covered in subpart 2B, moreover, iron must predominate, by weight, over each of the other elements. As indicated in headnote 2(g) to subpart 2B, steel is an alloy of iron and carbon which is malleable as first cast. Although the carbon content of steel generally ranges from 0.04 to 2.00 percent, steel containing more than 0.6 percent, by weight, of carbon is universally regarded as high-carbon steel. Steel may contain elements other than iron or carbon that have been added to enhance one or more properties, and it may contain elements unavoidably retained from raw materials.

The addition of one or more certain elements to iron or steel imparts special properties such as hardness, strength, resistance to heat and corrosion, and electrical properties. Such elements are added to steel in pure form or by the introduction of addition agents such as ferroalloys or other metal oxides or alloys. 1/ The presence of very small quantities of other elements, separately or in combination, may significantly upgrade the quality of iron or steel; less than a pound may be required for each ton of metal produced. Depending on their characteristics, addition agents are added to a heat when the steel furnace is being charged, or during melting, or after tapping but before teeming (pouring from ladle to ingot mold), or before the molten metal solidifies in the ingot mold. In the production of alloy steel largely from scrap by means of the electric furnace process, the alloying ingredients are added only to supplement those already present in the alloy scrap selected for the charge. Among the metals commonly added

1/ Ferroalloys are discussed in vol. 6:3; the other addition agents are discussed in vol. 6:1, 6:2, or 6:3 (see summary on the particular metal).

in the production of alloy iron or steel are chromium, cobalt, copper, lead, molybdenum, nickel, selenium, silicon, tantalum, titaniun, tungsten, vanadium, and zirconium.

The term "iron or steel" as used in the TSUS includes alloy iron or alloy steel, unless the context requires otherwise. As indicated in headnote 2(h) to subpart 2B, the term "alloy" designates a type or grade of iron or steel containing one or more listed elements, by weight, in excess of specified quantities. In general usage, the term "alloy steel" is construed to mean all steel composed in part of elements intentionally added to improve the properties of the metal. Types of steel that do not meet the specifications for alloy steel in headnote 2(h) mentioned above constitute the great bulk of the world's steel output, and in the trade, as well as in the following summaries, they are frequently referred to as carbon (or ordinary or unalloyed) steel.

Of the numerous types of alloy steel commonly produced, only stainless steel is defined in the TSUS; see headnote 2(h)(i) to subpart 2B. For tariff purposes, stainless steel is an alloy steel containing, by weight, less than 1 percent of carbon and over 11.5 percent of chromium. Some of the other common types of alloy steel are known as high-strength low-alloy steel, constructional alloy steel, alloy tool steel, heat-resisting steel, and electrical (silicon) steel. For purposes of reporting imports of alloy steel in the official statistics, heat-resisting steel is defined as alloy steel containing, by weight, less than 0.3 percent of carbon and from 4.0 to 11.5 percent, inclusive, of chromium. Also for statistical purposes, tool steel is defined as alloy steel containing, by weight, any of the following combinations of elements (as stated in statistical headnote 1 to subpart 2B):

(i) not less than 1.0% carbon and over 11.0% chromium; or
(ii) not less than 0.3% carbon and 1.25% to 11.0% inclusive chromium; or
(iii) not less than 0.85% carbon and 1% to 1.8% inclusive manganese; or
(iv) 0.9% to 1.2% inclusive chromium and 0.9% to 1.4% inclusive molybdenum; or
(v) not less than 0.5% carbon and not less than 3.5% molybdenum; or not less than 0.5% carbon and not less than 5.5% tungsten.

The term "high speed tool steel" is used to refer to all tool steel which meets the specifications set forth in (v) above.

In accordance with headnote 4 to subpart 2B, certain alloy iron or steel products containing chromium, molybdenum, tungsten, or vanadium

are subject to the duties provided in the TSUS items where they are classifiable and to the additional cumulative duties provided in items 607.01, 607.02, 607.03, and 607.04. These additional duties, which are intended to be compensatory for the duties on ferroalloys and on certain ores (viz, molybdenum and tungsten), 1/ apply only to the products covered by 46 TSUS items in subpart 2B (including spiegeleisen, not in this volume) which make specific reference to headnote 4.

Chromium is used primarily to prevent corrosion but also to increase hardness, strength, and wear resistance; its presence, however, tends to reduce ductility. Chiefly because of its use in the manufacture of stainless steels, chromium is consumed in larger quantities in steelmaking than any of the other three alloying elements subject to the additional cumulative duties considered here.

Molybdenum is commonly used to increase the hardness and strength of steel because its presence does not affect ductility or machinability. In heat-resisting steels, molybdenum aids in preventing deformation at elevated temperatures; in stainless steels, it enhances corrosion resistance, particularly at high temperatures; and in tool steels, it is often used in conjunction with tungsten to achieve the hardness required by high cutting speeds.

Tungsten, one of the alloying elements first used in the production of alloy steel, imparts hardness that will withstand high temperatures, increases resistance to abrasion, and improves electrical properties. Although tungsten and molybdenum affect the properties of steel similarly, more tungsten is usually required to accomplish the desired results. Steels containing tungsten are used widely in the manufacture of metal-cutting tools, magnets, armorplate, and armor-piercing projectiles.

Vanadium in small quantities increases the hardness, strength, and toughness of steel. Although the presence of vanadium tends to reduce machinability, it imparts a high degree of resistance to stresses. Steels containing vanadium are therefore suitable for use in the manufacture of products that are subjected to severe service, such as valve springs and gears. In recent years the increased production of high-strength, low-alloy steel for line pipe, structural shapes, and plates has resulted in increased consumption of vanadium. Vanadium has also been used as a substitute for molybdenum when the latter material has been in short supply.

1/ Chromium ore and vanadium ore are duty-free.

The current column 1 rates of the additional duties applicable to imports covered by the TSUS items that make specific reference to headnote 4 (see also general headnote 3 in appendix A) are as follows:

TSUS item	Rate of additional duty
607.01	1.5¢ per lb. on chromium content in excess of 0.2% by weight
607.02	35¢ per lb. on molybdenum content in excess of 0.1% by weight
607.03	50¢ per lb. on tungsten content in excess of 0.3% by weight
607.04	40¢ per lb. on vanadium content in excess of 0.1% by weight

These rates, which reflect concessions granted by the United States in the General Agreement on Tariffs and Trade, were derived from the additional cumulative duties in paragraphs 301 and 305 of the former tariff schedules that were applicable to specified iron or steel products containing more than certain minimum percentages of the elements considered here. In the TSUS, the minimum percentages for chromium and vanadium were unchanged, but those for the other two elements were modified slightly to conform with the definitions for alloy iron and steel in headnote 2(h) to subpart 2B; the minimum percentage for molybdenum was reduced from 0.2 percent to 0.1 percent and that for tungsten was increased from 0.2 percent to 0.3 percent. The present rates applicable to chromium and tungsten content--disregarding the change in minimum percentages--have been in effect since January 1, 1948, and those applicable to molybdenum and vanadium content, since June 6, 1951, and July 1, 1963, respectively.

Official statistics on U.S. imports of the alloy iron or steel products containing elements subject to additional cumulative duties are not reported in a manner that permits computation of the ad valorem equivalents of such duties. A review of the available data on the 1964 imports of such alloy iron or steel products, however, indicated that (1) there were no imports reported in 12 of the 46 TSUS items subject to duties on "excess" alloy content and (2) the estimated ad valorem equivalents of the additional cumulative duties applicable to the dutiable imports entered under the other TSUS items--all included in this volume--ranged from less than 1 percent (for 18 TSUS items) to 4.3 percent (for 2 TSUS items). The foregoing range of estimated ad valorem equivalents does not apply to the "excess" alloy content of imported waste and scrap, on which the Congress has suspended all import duties almost continuously since March 1942.

The quantities of the four alloying elements subject to the additional duties provided for in items 607.01 to 607.04 are reported in the official U.S. import statistics by the kinds of products in which they are embodied; such data for 1964-66 are shown in the accompanying table. The quantities shown in the table represent only the amounts of the named elements subject to the additional cumulative duties; they include the content of "excess" elements in articles entered duty free pursuant either to special provisions of schedule 8 of the TSUS or to legislation temporarily amending the provisions of schedule 6 and reflected in the appendix to the TSUS, such as the legislation suspending all import duties on waste and scrap of iron or steel. In 1966, for example, the substantial imports of alloy steel ingots, blooms, billets, slabs, and sheet bars entered free under bond for manufacture (principally rolling) and export (as provided in item 864.05) contained about 80 percent of the 14,858,000 pounds of "excess" chromium in such articles, 70 percent of the 622,000 pounds of molybdenum, and 15 percent of the 21,000 pounds of tungsten. Moreover, the duty-free imports of waste and scrap of alloy iron or steel mentioned above contained in 1966 about 16 percent of both the 2,883,000 pounds of "excess" chromium and the 1,064,000 pounds of molybdenum in "other" products.

Alloying elements subject to additional duties under items 607.01 to 607.04, by kinds of products in which imported, 1964-66

(In thousands of pounds)

Product	Chromium			Molybdenum		
	1964	1965	1966	1964	1965	1966
Bars	1,652	2,425	3,001	332	376	571
Wire rods	3,069	3,346	4,696	77	117	400
Ingots, blooms, billets, slabs, and sheet bars	5,938	15,092	14,858	130	362	622
Plates, sheets, and strip	10,973	15,474	20,911	115	131	221
Pipes, tubes, and blanks therefor	1,022	1,619	2,283	57	130	179
Wire	1,617	2,218	3,492	52	70	121
Other	1,451	1,782	2,883	977	734	1,064
Total	25,722	41,955	52,123	1,741	1,919	3,176

	Tungsten			Vanadium		
	1964	1965	1966	1964	1965	1966
Bars	211	276	373	101	155	166
Wire rods	4	11	23	4	11	19
Ingots, blooms, billets, slabs, and sheet bars	5	14	21	14	21	27
Plates, sheets, and strip	12	25	46	4	9	18
Pipes, tubes, and blanks therefor	1	1	2	2	4	3
Wire	11	17	48	6	11	18
Other	30	38	58	10	11	10
Total	274	381	571	141	220	261

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Tin plate scrap	607.10
Iron or steel scrap	607.11, -.12

Note.--For the statutory description of each item, see the Tariff Schedules of the United States (pertinent provisions thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on page 23.

U.S. trade position

The value of annual U.S. consumption of iron and steel scrap ranges between $1.5 and $2.5 billion. In recent years, imports have composed less than 1 percent of the new supply of available scrap, and exports have taken from 5 to 15 percent.

Description and uses

In this summary the term "scrap" means "waste and scrap" as defined in headnote 3(b) to part 2 of schedule 6, viz, "materials and articles of metal which are second-hand or waste or refuse, or are obsolete, defective or damaged, and which are fit only for the recovery of the metal content or for use in the manufacture of chemicals, and does not include metal in unwrought form or metal-bearing materials provided for in part 1 of this schedule." Metal articles, new or second-hand, that are fit for other use and are to be used in remanufacture by melting are not classifiable for tariff purposes under the provisions considered here, but under the provisions for the particular articles.

Tin plate scrap, which consists almost entirely of scrap generated in the production of both tin plate and tin plate containers, is used for the recovery of tin. The tin recovered from tin plate scrap constitutes a minor part of U.S. requirements for tin; see summary on item 622.02 et al. in volume 6:2. The steel scrap resulting from the detinning of tin plate scrap is, for tariff purposes, steel scrap (generally of the type provided for in item 607.11); it is compressed or baled and used in the production of iron and steel, as are the other forms of iron or steel scrap included in this summary. Tin plate scrap is seldom, if ever, used in its original condition in steel furnaces because tin unites readily with the steel and is difficult to remove. Even a small amount of tin will contaminate an entire heat and cause the resulting steel to be brittle and have poor surface characteristics.

The other scrap covered by this summary (items 607.11 and 607.12) is one of the two major sources of iron metallics used in the production of iron and steel. More than 99 percent of the iron and steel scrap consumed in the United States is used for making iron and steel; scrap constitutes about 45 percent of the total amount of iron-bearing material charged into furnaces for making iron and steel. Minor quantities of iron and steel scrap are used in the production of ferroalloys and for other miscellaneous purposes.

Iron and steel scrap is categorized generally by its origin. Revert, or home, scrap is generated by a steel plant or foundry in the process of making its products. It includes the following: Products rejected during processing because of damage or chemical or physical variations from specifications; cropped ends of ingots, blooms, billets, and slabs; trimmings resulting from cutting flat-rolled products to exact size; ends cut from bars, structural shapes, and tubing; machine turnings; and gates, risers, and rejects from casting operations. Revert scrap is generally used in the plants where it is generated; small amounts are transferred from one plant to another of the same steel company. In steel plant operations, as much as 30 percent of the steel made (steel ingots and steel for castings) becomes revert scrap and is recharged into steel furnaces as soon as practicable.

Another class of scrap is called prompt industrial scrap. This material is generated by steel fabricators; it consists of machine turnings, scrap resulting from stamping operations, borings, products rejected during manufacture, and other remnants. Recently, iron and steel turnings and borings have been added to iron ore fines that are being agglomerated before use in blast furnaces.

Dormant scrap, the third category of iron and steel scrap, consists of discarded, wornout, or obsolete articles of iron or steel, including washing machines, driers, and other consumer goods, railroad scrap, beams, girders, and other sections from demolished structures, iron and steel from shipbreaking operations, wrecked or discarded automobiles, trucks, and buses, and outdated industrial machinery and handling equipment. Prompt industrial scrap and dormant (obsolete) scrap are generally referred to collectively as purchased scrap because they are purchased by steel mills from scrap dealers or processors.

To avoid the introduction into the melt of unwanted elements (either those not needed for the particular steel being made, or those, such as tin and copper, which interfere with processing and cannot be economically removed), proper separation and classification of scrap is very important. Revert scrap, of course, poses little difficulty in this respect since steel companies maintain continuous records of the composition and origin of "in-process" steel and can recharge the scrap when and where it will be most economically utilized. Prompt industrial scrap also causes no problems in preparation because, with adequate

precautions by scrap dealers, its origin and identity are known. In addition, such scrap is generally clean, that is, not contaminated with other materials, such as paper, solder, paint, rubber, plastics, or nonferrous metals. On the other hand, extreme care must be taken in the preparation of the large tonnages of dormant scrap; the iron and steel content of such scrap must be separated from the other materials and packaged in a form that facilitates handling and charging into steel furnaces.

There are 75 or more different grades of iron and steel scrap for which standard specifications have been adopted. These standards are frequently revised as the techniques for producing steel and articles containing iron and steel advance. The grades vary according to the type of scrap (i.e., whether of steel or of cast or malleable iron), size of the scrap, composition, metallic or nonmetallic coatings, and form (loose, bundled, or compressed). The carbon steel grades designated as No. 1 heavy-melting scrap and No. 1 bundles are the most common grades of scrap used by the steelmakers; cast-iron scrap is used primarily by iron foundries, though some is used by producers of steel.

In this summary all quantities are given in terms of long tons (2,240 pounds).

U.S. tariff treatment

The current column 1 rate of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
607.10	Tin plate waste or scrap----------	Free.
	Other iron or steel waste and scrap:	
607.11	Containing by weight not over 0.2 percent of chromium, 0.1 percent of either molybdenum or vanadium, or 0.3 percent of tungsten.	37.5¢ per ton.
607.12	Other----------	37.5¢ per ton + additional duties. 1/

1/ As provided under items 607.01 to 607.04 (see appendix A).

The duty-free treatment of tin plate scrap, which was also provided for under paragraph 1786 of the former tariff schedules, has been bound in a concession granted by the United States in the General Agreement on Tariffs and Trade (GATT), effective January 1, 1948. The 37.5-cent-per-ton rates for items 607.11 and 607.12, which are the same as the rates provided for under paragraph 301 of the former tariff schedules, also reflect a GATT concession effective January 1, 1948.

To stimulate imports and help alleviate an acute shortage of steel scrap during World War II, the duty applicable to iron and steel scrap of the kind provided for under items 607.11 and 607.12 was suspended by an act of Congress. This suspension of duty, which has been in effect almost continuously since March 1942, is reflected in item 911.12 of the appendix to the TSUS. The current authority for the suspension (Public Law 90-45), which expires on June 30, 1969, provides not only for the free entry of iron or steel scrap (items 607.11 and 607.12), but also for the free entry of (1) articles of iron or steel (new or second-hand) classifiable elsewhere that are to be used in remanufacture by melting; (2) iron or steel in the form of pigs, ingots, or billets which have been produced from melted-down scrap to facilitate handling and transporting but which have not been sweetened, alloyed, or deliberately purified, and which cannot be used without remanufacture; and (3) relaying and rerolling rails.

The ad valorem equivalent of the 37.5-cent-per-ton rate is 1.4 percent, computed on the basis of the average unit value of the duty-free imports entered in 1966 under item 607.11, and 2.8 percent on the basis of the corresponding imports entered under item 607.12. (For discussion of the additional specific duties on the chromium, tungsten, molybdenum, and vanadium content, under items 607.01 to 607.04, see general statement on the provisions of subpart 2B of schedule 6.)

U.S. consumption

In recent years annual U.S. consumption of tin plate scrap, as measured by the volume of such scrap treated, ranged between 673,000 and 794,000 tons. Annual domestic consumption of iron and steel scrap of the types provided for in items 607.11 and 607.12 increased almost without interruption from about 51 million tons in 1958 to more than 81 million in 1965 and to 82 million in 1966 (table 1). As would be expected, annual consumption of iron and steel scrap varies directly with the production of iron and steel, but is also affected by changes in the shares of total steel output produced by the various steelmaking processes, inasmuch as the amount of scrap used to produce a ton of steel depends on the steelmaking process employed. In 1966, scrap constituted about 2 percent of the total iron-bearing metal (scrap or pig iron) charged into bessemer steelmaking furnaces in the United States, 29 percent of that charged into basic-oxygen furnaces, 41 percent of that charged into open-hearth furnaces, and about 98 percent of that charged into electric steelmaking furnaces.

The following tabulation, compiled from official data of the U.S. Department of the Interior (except as noted), shows the domestic

consumption of iron and steel scrap in all uses, by type of furnace, in selected years 1958 to 1965 (in thousands of long tons):

	1958	1961	1964	1965
Steelmaking furnaces:				
Open-hearth	30,663	33,815	39,180	39,040
Electric	7,188	9,020	13,270	14,905
Bessemer converters	1/ 198	97	106	71
Basic-oxygen converters	1/ 366	1,224	4,898	6,941
Other:				
Cupolas	7,727	8,492	11,971	13,197
Blast	2,551	3,170	4,300	4,513
Air	822	880	1,287	1,382
Total	50,321	57,435	75,559	80,678

1/ Estimated by U.S. Tariff Commission.

Of total U.S. consumption of iron and steel scrap (other than tin plate scrap) in 1965, 34 percent consisted of No. 1 heavy-melting scrap; 18 percent, of cast-iron scrap and cast-iron borings; and 8 percent, of No. 1 bundles and electric furnace bundles. Sixty-eight percent of the total iron and steel scrap consumed in that year was used in the five principal steel-producing States, namely, Pennsylvania, Ohio, Indiana, Illinois, and Michigan.

The changing technology of steelmaking will continue to have considerable effect on iron and steel scrap consumption. The increased use of highly processed domestic iron ore and of high-quality imported iron ore has had a tendency to reduce the consumption of scrap in blast furnaces and steel furnaces. The increase in steel produced by the basic-oxygen process--a process that, as already noted, usually consumes smaller proportions of scrap than the other principal steelmaking processes 1/--also has had a retarding effect on scrap consumption. Moreover, there is a pronounced tendency for integrated steel producers to utilize a larger proportion of hot metal (their own pig iron) in steelmaking furnaces, a practice which reduces their requirements for purchased scrap.

As more firms install continuous casting machines for the direct casting of slabs and billets, the demand for purchased scrap should increase significantly--assuming continued high-level steel output--because substantially less revert (home) scrap is generated by

1/ The proportion of scrap used in the basic-oxygen process has increased significantly since the adoption of the process, and substantially larger than average charges have been successfully utilized.

the continuous process than by the more conventional multistep process of casting ingots and then rolling the required forms. On the other hand, the fact that steel consumers are becoming increasingly particular about the quality and uniformity of the steel they purchase necessarily results in the generation of more home scrap.

Research on a new steelmaking process--FOS (fuel-oxygen-scrap)--is being conducted in the United Kingdom. Although a charge of scrap and pig iron may be used, a charge entirely of cold scrap in any form, heavy or light, has apparently proved successful in a pilot-plant operation. Should this process be broadly adopted, it would have a stimulating effect on the demand for iron and steel scrap.

U.S. producers

The producers of iron and steel, by far the principal consumers of iron and steel scrap, generate large quantities of revert (home) scrap which they utilize, but they must also rely on outside sources for purchased scrap. Many different types of entrepreneurs play a role in the collection, processing, and marketing of such scrap. The "junk" dealer (or collector) assembles and sorts all kinds of waste materials (such as paper, textiles, plastics, nonferrous metals, iron and steel, and glass) which he sells principally to appropriate scrap processors. The auto wrecker collects old, wrecked, or abandoned motor vehicles, removes the serviceable components for sale (largely to do-it-yourself mechanics), and generally sells what remains of the vehicles to collectors or processors. The junk dealer and auto wrecker have little, if any, equipment specially designed for preparing iron and steel scrap for use in manufacturing. Such equipment is owned by the processors of iron and steel scrap, who buy crude scrap from junk collectors, auto wreckers, industrial plants, and other sources and "manufacture" 1 or more of the 75 standard grades of ferrous scrap for sale to steel mills and foundries. Iron and steel scrap which has been separated from other scrap materials is cut, shredded, pulverized, bundled, or compressed into usable forms. A modern plant for processing iron and steel scrap is a major investment, costing as much as $1 million. The continuous demands of the iron and steel industry for cleaner and better prepared scrap have resulted in significant technological developments in scrap processing, including complicated automated machinery capable of handling large daily tonnages.

Another important participant in the iron and steel scrap business is the broker, whose primary function is to facilitate transactions between consumers and processors of scrap; he often also acts as an agent to obtain unprepared scrap for processors. Most brokers also operate their own processing yards, primarily as a hedge against a temporary shortage of prepared scrap.

While almost every town and city in the United States has one or more of the types of entrepreneurs mentioned, scrap processors are fewest in number. Many such processors are located near steel-producing centers. The regular membership of the Institute of Scrap Iron and Steel, Inc. (a trade association), consists of about 1,200 scrap processors and scrap brokers, who account for about 90 percent of aggregate annual sales of processed iron and steel scrap.

U.S. supply

Table 1 shows the approximate new supply of iron and steel scrap (including tin plate scrap) available for U.S. consumption in each of the years 1958-65. The derivation of the new supply of scrap (exclusive of tin plate scrap for which data are not available) in 1962-65 was as follows (in thousands of long tons):

	Home scrap	Purchased scrap	Disposals 1/	Total new supply
1962---------	36,290	24,552	1,978	58,864
1963---------	39,871	28,792	2,514	66,149
1964---------	46,663	32,736	4,315	75,084
1965---------	49,297	36,821	4,853	81,265

1/ Include shipments, transfers, or other disappearance.

In addition to the annual new supply shown, processors' yearend stocks of scrap, including both prepared and unprepared, are believed to be very large. The potential supply of iron and steel scrap in automobile graveyards and in the hands of junk dealers is also very large. The data for "purchased scrap" include purchases from dealers and other sources as well as interplant transfers.

The price of iron or steel scrap varies widely according to grade from a range of about $10 to $20 per ton for the least desirable grades to as much as $200 or more per ton for clean high-alloy scrap. The price of scrap is sensitive to the changing levels of manufacturing activity in iron and steel. The annual average price of No. 1 heavy-melting steel scrap at Pittsburgh, Pa., after reaching a high of $53.37 in 1956, declined almost without interruption to $26.93 in 1963, then its lowest postwar level. Monthly averages during the period 1956-63 ranged between $67.00 in December 1956 to $23.63 in November 1962. The downward trend was interrupted as the annual average price of No. 1 heavy-melting scrap increased in 1964 (to $34.75) and again in 1965 (to $35.10); however, the monthly average price of No. 1 heavy-melting scrap at Pittsburgh declined from $33.62 in January 1966 to $27.00 in December of that year, and the annual average for 1966 was $30.72.

U.S. exports

In 1952 the United States again became a net exporter of iron and steel scrap, its trade status prior to World War II. Exports reached a record high in 1961, when they amounted to 8.4 million tons, but declined by almost 50 percent in 1962 (table 1). Although exports increased in 1963 and 1964, they declined in 1965 and again in 1966, being about 26 percent smaller in 1966 than in 1964.

U.S. exports of iron and steel scrap, like U.S. consumption, consist primarily of No. 1 heavy-melting scrap. This grade accounted for almost 40 percent of total exports of iron and steel scrap during the period 1963-66, whereas scrap of grades No. 2 heavy-melting and No. 2 bundles, somewhat less desirable grades from the standpoint of domestic steel producers, comprised about 17 and 22 percent, respectively, in that period. Steel scrap of No. 1 bundles and cast-iron scrap have together accounted for only about 11 percent of exports in recent years.

For many years Japan has been by far the leading market for U.S. exports of iron and steel scrap (table 2). In recent years, Canada, Mexico, and Italy have also been consistent export markets. In 1958-66 the annual average unit values of U.S. exports of No. 1 heavy-melting scrap were substantially higher than the annual average quoted prices for the same grade in the United States, indicating that foreign markets, particularly Japan, are more favorable markets for such scrap than the United States (table 3). Except for the scrap generated in their own steel mill operations, Japanese steel producers depend on imports for raw materials. Scrap from the United States accounts for as much as 30 percent of Japan's annual supply of iron and steel scrap.

U.S. imports

In the last decade annual imports of iron and steel scrap ranged between 297,000 tons (in 1958) and 160,000 tons (in 1960), providing substantially less than 1 percent of the supply of such scrap available in the United States. They amounted to 190,706 tons in 1965 and to 250,064 tons in 1966 and consisted principally of scrap of the kind provided for under item 607.11 (table 4). Tin plate scrap (607.10), and iron and steel scrap containing chromium, molybdenum, tungsten, and vanadium (607.12) comprised about 14 percent of total imports in 1965 and 10 percent in 1966.

Canada has long been by far the principal source of imports of iron and steel scrap and virtually the only source of tin plate scrap. West Germany, Spain, Brazil, Ireland, and Mexico are a few of the many countries from which small and sporadic imports have been

received during recent years. The following tabulation demonstrates Canada's domination of the U.S. import trade in 1958-66:

Year	Total U.S. imports	Imports from Canada	
		Quantity	Percent of total
	1,000 long tons	1,000 long tons	
1958	297	282	95
1959	276	231	84
1960	160	143	89
1961	240	238	99
1962	188	184	98
1963	194	187	96
1964	252	241	96
1965	191	184	96
1966	250	240	96

U.S. imports of iron and steel scrap have been affected by the imposition from time to time of complete or partial export embargoes by the European Coal and Steel Community, the United Kingdom, India, and other countries. The prohibition of exports of scrap is a device for avoiding a drain on a country's supply at times when scrap prices in export markets are higher than those at home. The imposition of export embargoes by foreign countries has reduced the stimulating effect on U.S. imports that was anticipated by the suspension of the U.S. import duty on iron and steel scrap.

Table 1.--Iron and steel scrap: U.S. new supply, imports, exports, and consumption, 1958-66

Year	New supply available for consumption 1/	Imports	Exports	Consumption 1/
	Quantity (1,000 long tons)			
1958	51,559	297	2,583	50,884
1959	60,043	276	4,290	59,686
1960	59,369	160	6,306	60,031
1961	57,647	240	8,427	58,135
1962	59,571	188	4,478	59,777
1963	66,822	194	5,551	67,299
1964	75,845	251	6,923	76,321
1965	81,660	190	5,509	81,472
1966	82,205	250	5,135	81,771
	Value (1,000 dollars)			
1958	2/	11,096	93,082	2/
1959	2/	11,591	162,752	2/
1960	2/	6,273	235,227	2/
1961	2/	9,085	338,526	2/
1962	2/	6,109	144,112	2/
1963	2/	6,104	167,711	2/
1964	2/	8,267	236,475	2/
1965	2/	7,451	197,459	2/
1966	2/	8,207	171,907	2/

1/ Includes tin plate scrap processed.
2/ Not available.

Source: New supply and consumption compiled from official statistics of the U.S. Department of the Interior; imports and exports compiled from official statistics of the U.S. Department of Commerce.

Table 2.--Iron and steel scrap: U.S. exports of domestic merchandise, by principal markets, 1964-66

Market	1964	1965	1966
	Quantity (long tons)		
Japan	3,472,325	2,123,356	2,749,336
Mexico	709,634	765,159	693,239
Canada	753,601	902,580	653,698
Republic of Korea	37,014	85,057	249,473
Italy	591,088	682,585	287,296
Taiwan	128,796	299,671	114,961
All other	1/ 1,230,983	650,311	386,753
Total	6,923,441	5,508,719	5,134,756
	Value (1,000 dollars)		
Japan	120,335	73,992	87,880
Mexico	24,801	28,949	25,088
Canada	23,874	33,903	21,237
Republic of Korea	1,578	3,959	9,764
Italy	17,287	20,651	8,833
Taiwan	5,664	11,995	5,210
All other	1/ 42,936	24,010	13,895
Total	236,475	197,459	171,907

1/ Includes 441,164 tons, valued at 16,136 thousand dollars, exported to West Germany.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note.--Data for 1966 do not include iron or steel rerolling material (95,767 tons, valued at 5,043 thousand dollars) that was first separately reported in that year. About three-fifths of these 1966 exports went to Taiwan.

Table 3.--Steel scrap: Annual average price at Pittsburgh and annual average unit value of exports of No. 1 heavy-melting scrap, 1958-66

(Per long ton)

Year	Average price at Pittsburgh, Pa.	Average unit value of exports	
		To all countries	To Japan
1958	$38.10	$39.19	$39.41
1959	40.11	41.62	42.09
1960	32.87	40.88	41.15
1961	35.22	44.00	45.60
1962	29.28	36.24	39.18
1963	26.93	33.87	35.30
1964	34.75	38.79	40.01
1965	35.10	38.63	40.18
1966	30.72	35.31	35.09

Source: Price at Pittsburgh from The American Metal Market; average unit value of exports computed from official statistics of the U.S. Department of Commerce.

Table 4.--Iron and steel scrap: U.S. imports for consumption, by tariff classification (identified by TSUS item numbers), 1958-66

Year	TSUS item 607.10	TSUS item 607.11	TSUS item 607.12	Total
	Quantity (long tons)			
1958	32,824	264,100	60	296,984
1959	37,151	239,068	74	276,293
1960	36,352	123,828	-	160,180
1961	29,499	210,105	29	239,633
1962	18,832	168,623	115	187,570
1963	19,486	170,422	4,027	193,935
1964	20,143	225,147	6,307	251,597
1965	17,954	164,951	7,801	190,706
1966	14,687	225,492	1/ 9,885	250,064
	Value (1,000 dollars)			
1958	1,000	10,050	19	11,069
1959	1,098	10,483	10	11,591
1960	992	5,281	-	6,273
1961	770	8,313	2	9,085
1962	341	5,710	58	6,109
1963	403	5,406	295	6,104
1964	472	7,205	590	8,267
1965	451	5,843	1,157	7,451
1966	535	6,008	1/ 1,664	8,207

1/ Excludes 1 shipment, valued at $858, for which the quantity reported appeared to be in error.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Pig iron and cast iron containing by weight not over 0.2 percent of chromium, 0.1 percent of either molybdenum or vanadium, or 0.3 percent of tungsten---	607.15
Other pig iron and cast iron----------	607.18

Note.--For the statutory description see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

In the United States, the world's largest producer and consumer of pig iron, about 95 percent of the domestic output is consumed by the producing firms. Although U.S. foreign trade in pig iron is extremely small compared with total domestic production, recent imports have been equivalent to almost 25 percent of the annual U.S. supply of merchant pig iron, i.e., the pig iron (domestic and foreign) in commerce.

Description and uses

The terms "pig iron" and "cast iron" are synonymous. For tariff purposes they refer to a ferrous product, other than steel, which contains by weight 1.9 percent or more of carbon and which may contain other elements within specified limits (see headnotes 2(a) and 2(b) to pt. 2B of schedule 6 of the TSUS in appendix A).

Most pig iron contains 90 to 94 percent of iron, 2.5 to 5.0 percent of carbon, and small amounts of silicon, manganese, phosphorus, and other elements, almost all of which are carried over from the raw material used in its production. Some types of pig iron, however, contain substantial percentages of tungsten, chromium, vanadium, titanium, or other metals, with correspondingly smaller percentages of iron. Pig iron containing one or more of certain elements in the quantity, by weight, prescribed in headnote 2(h) to part 2B of schedule 6 are designated "alloy" irons. Pig iron intended for steelmaking, by far its major use, rarely contains alloying elements in these proportions.

Pig iron is the principal product of the blast furnace, others being ferromanganese (items 607.35, 607.36, and 607.37), spiegeleisen (items 607.20 and 607.21), and ferrophosphorus (item 607.45), all of which are discussed in volume 6:3. The principal essential

ingredients charged into the top of the blast furnace are iron ore (including concentrates and agglomerates), coke, and a fluxing material such as limestone. Ferrous scale, iron scrap, and slag are very often utilized as supplemental sources of iron. The oxygen in the blast of hot air (or oxygen-enriched hot air) introduced into the blast furnace initiates a continuous chemical process that results in the accumulation of molten metallic iron (pig iron) at the bottom of the furnace. A liquid slag--consisting of the fluxing materials, ore impurities (gangue), coke residuals, and other unwanted materials--floats on top of the molten iron. When an appropriate amount of molten iron has accumulated, the furnace is tapped. Extremely small quantities of pig iron are produced in electric smelting furnaces or by melting steel scrap and additional carbon.

Pig iron is one of the major iron-bearing materials for the production of steel. Most pig iron tapped from blast furnaces is transferred in the molten state ("hot metal") in specially constructed ladle cars directly to nearby steelmaking furnaces owned by the pig iron producers. Substantial quantities are cast into pigs and other primary forms, principally for shipment to other firms for further manufacture. Significant quantities of pig iron are cast directly into articles such as ingot molds and pipe and some is granulated by dropping it into a vessel of water. The pig iron sold to others is known as merchant pig iron; in 1966, about 30 percent of such pig iron was transferred to the buyer in the molten state. Various reduction processes designed to convert iron ore directly to high-purity iron are being investigated and may some day obviate the blast-furnace operation in the production of steel.

Foundries that do not have blast furnaces are by far the principal consumers of merchant pig iron. These producers of castings melt, commonly in a cupola furnace, merchant pig iron of different grades together with cast-iron scrap or steel scrap, and sometimes with ferroalloys or other metals. The addition of nonferrous metallic elements to the molten mixture is a common practice for adjusting the composition of the melt and enhancing one or more of the properties of the iron. The metals most frequently added include chromium, nickel, copper, molybdenum, titanium, and vanadium. Depending on the metal and the desired results, these metals are introduced as pure metal or in the form of ferroalloys either in the furnace or in the ladle prior to pouring the castings.

Pig iron, although a crude form of iron, is produced in several grades, which may be categorized by the type of raw materials used or by the chemical analysis of the pig iron itself. In the United States, grades of pig iron are commonly identified by intended use: in the production of steel, acid pig iron is used in acid furnaces and basic pig iron in basic furnaces; malleable pig iron is used principally in

the production of malleable castings; and foundry pig iron in the production of other castings. In terms of tonnage, basic pig iron is by far the most important.

Skulls, which result from the continuous buildup of pig iron on the bottom and sides of the ladles used to carry hot metal, have been held by the U.S. Bureau of Customs to be classified as pig iron under the provisions considered here (C.I.E. 203/67; T.D. 67-62(14)). This material, which is virtually the same as pig iron in composition, must be removed from the ladles periodically.

In this summary, all quantities are given in terms of long tons (2,240 pounds).

U.S. tariff treatment

The current column 1 rates of duty (see general headnote 3 in appendix A) applicable to imports are as follows:

TSUS item	Commodity	Rate of duty
	Pig iron and cast iron in pigs, blocks, lumps, and similar forms:	
607.15	Containing by weight not over 0.2 percent of chromium, 0.1 percent of either molybdenum or vanadium, or 0.3 percent of tungsten----------	20¢ per ton.
607.18	Other----------	56.25¢ per ton + additional duties. 1/

1/ As provided under items 607.01 to 607.04 (see appendix A).

These rates for pig iron are the same as the rates provided under paragraph 301 of the former tariff schedules and reflect concessions granted by the United States under the General Agreement on Tariffs and Trade. The rate of 20 cents per ton became effective on July 1, 1962, and the rate of 56.25 cents per ton, on January 16, 1956.

As indicated in subdivision (e) of general headnote 3 mentioned above, products of the U.S.S.R. and other designated Communist countries, which accounted for a significant portion of the imports entered under item 607.15 in 1965 and 1966, are dutiable at the column 2 rates, e.g., $1.125 per ton for item 607.15.

An embargo on U.S. imports from Southern Rhodesia of pig iron and certain other products, as well as products made from such Rhodesian products, was proclaimed by the President on January 7, 1967, in Executive Order 11322 (32 F.R. 119).

On imports in 1966 reported under item 607.15 and dutiable at the column 1 rate (20 cents per ton), the ad valorem equivalent of the duty was 0.4 percent. On the imports dutiable in 1966 under item 607.15 at the column 2 rate ($1.125 per ton), the ad valorem equivalent of the duty was 3.3 percent. In 1966, the first year that imports of pig iron of a type classifiable under 607.18 were significant, they consisted almost entirely of pigs entitled to duty-free treatment under the provisions of Public Law 89-61; see item 911.12 in appendix A. 1/ The ad valorem equivalent of the column 1 rate of duty for item 607.18 (56.25 cents per ton), based on the small entry of dutiable imports in 1966, was 0.5 percent, exclusive of the additional specific duties on the chromium, tungsten, molybdenum, and vanadium contents.

U.S. consumption

Annual consumption of pig iron increased almost without interruption from the 1958 recession level of about 51 million tons to 65 million in 1963, and to about 77 million in 1964 (table 1). Spurred by a rising demand for steel products, consumption of pig iron increased to about 82 million tons in 1966. The rise in U.S. consumption of pig iron from 1958 on has been entirely in the production of steel, as shown by the following data of the U.S. Department of the Interior on consumption in selected years from 1958 to 1966, by type of product (in thousands of long tons):

	1958	1961	1965	1966
Steel ingots and steel for castings (raw steel)----	47,377	54,964	75,471	78,026
Iron foundry and miscellaneous products------	3,750	3,784	3,944	3,911
Total----------	51,127	58,748	79,415	81,937

One factor that has contributed to the increasing use of pig iron in steelmaking during the last decade has been the growing use

1/ See also tariff treatment section of the preceding summary on waste and scrap of iron or steel.

of the basic-oxygen process for producing steel, a process that consumes on the average about 0.8 ton of pig iron per ton of steel produced, in contrast with the still dominant open-hearth process, which consumes 0.67 ton of pig iron per ton of steel produced. Both processes consume substantial quantities of scrap (see preceding summary). The following tabulation compiled from official statistics of the U.S. Department of the Interior, except as noted, shows total domestic consumption of pig iron, by type of process, in selected years from 1958 to 1966 (in thousands of long tons):

	1958	1961	1965	1966
Open-hearth	43,221	48,760	54,896	49,561
Basic-oxygen	1/ 995	3,171	16,535	24,840
Bessemer	1/ 1,359	872	582	296
Electric	228	249	346	255
Cupola	3,312	3,070	3,354	3,274
Air	169	159	153	149
Direct castings	1,843	2,467	3,549	3,562
Total	51,127	58,748	79,415	81,937

1/ Estimated by the U.S. Tariff Commission.

The growing use of the basic-oxygen process of steelmaking from 1958 to 1966 resulted in an increase of nearly 9 percent in the average pig iron input per ton of steel produced by the open-hearth and basic-oxygen processes combined. These two types of steel furnaces accounted for 96.5 percent of total consumption of pig iron for steelmaking purposes in 1958 and for 99.2 percent in 1966.

Annual apparent consumption of merchant (or purchased) pig iron--estimated from producers' domestic shipments to others, plus imports, less exports--has trended downward in the last decade, both in absolute terms and in relation to total pig iron consumption. U.S. consumption of merchant pig iron amounted to 7.1 million tons, or 10.6 percent of total pig iron consumption, in 1956 and 5.4 million tons--9.8 percent--in 1959. Since 1959, annual consumption of merchant pig iron has ranged between 3.0 and 4.8 million tons; in 1966 it was equivalent to only 5.8 percent of total pig iron consumption.

Of the total pig iron consumed in the United States in 1965, slightly more than 70 percent was used in steel production by plants located in the country's five principal steel-producing States--Pennsylvania, Ohio, Indiana, Michigan, and Illinois. Pig iron consumed for purposes other than steelmaking was used largely in Alabama, where there is a concentration of producers of cast-iron pipe, and in Michigan, Ohio, Illinois, Indiana, and Wisconsin, where many of the leading producers of automotive and machinery castings are situated.

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U.S. producers

At the beginning of 1965 there were 30 domestic firms having, in the aggregate, 231 blast furnaces suitable for the production of pig iron, of which 184 (80 percent) were in operation. On January 1, 1959, the pig iron furnaces in operation numbered 178, representing 70 percent of the 255 furnaces then suitable for pig iron production. At the beginning of 1967, 158 blast furnaces were in operation in 15 States; 130 such furnaces were located in 7 States, namely, Pennsylvania (38), Ohio (29), Indiana (20), Illinois (12), New York (12), Alabama (10), and Michigan (9). Eight additional furnaces were idle for purposes of relining or rebuilding. Most U.S. blast furnaces are burdened with coke made from domestic coal and with a mixture of domestic and foreign iron ore; some, however, operate exclusively on domestic iron ore, and at least 13 operate exclusively on imported ore (see first summary in this volume relating to iron ore). The maximum effective capacity for annual production of pig iron in the United States is probably in excess of 100 million tons.

The great bulk of the U.S. output of pig iron is made by 22 integrated steel producers that consume pig iron principally in the molten state; about 5 of these producers also operate merchant furnaces. The remainder is produced in part by about 5 independent producers of merchant iron that cast most of their output into pigs and similar forms for shipment to other firms for further processing (although they ship some as hot metal), and in part by a number of integrated producers of iron products such as pipe and ingot molds. Through mergers, acquisitions, and suspension of operations, the number of independent merchant producers has declined appreciably over the years. The total U.S. output of merchant pig iron, which consists principally of foundry and malleable grades, is virtually all sold to iron foundries for remelting and casting into a wide variety of products and to steel producers that have only limited pig-iron-producing facilities, if any. Generally the captive production of pig iron by the integrated steel firms is of the steelmaking grades.

U.S. production

Domestic production of pig iron increased from about 51 million tons in the recession year of 1958 to more than 59 million tons in 1960. After declining somewhat in 1961, annual production increased substantially to 79 million tons in 1965 and to 82 million tons in 1966. Although there has been a marked upward trend in recent years, only in the years 1964-66 was pig iron production higher than the annual average during the 5-year period ending in 1957.

The entire increase in pig iron production from 1958 to 1966 consisted of basic pig iron--the grade used in basic open-hearth and

basic-oxygen furnaces for the production of steel--as indicated by data from the American Iron and Steel Institute shown in the following tabulation (in thousands of long tons):

Grade	1958	1961	1964	1965	1966
Basic	43,879	51,919	69,998	71,813	74,529
Bessemer	3,214	2,322	2,435	2,425	2,573
Malleable	2,058	1,877	2,030	2,505	2,543
Foundry	1,434	1,216	1,449	1,428	1,494
All other	449	372	455	565	557
Total	51,034	57,706	76,367	78,737	81,696

A number of innovations in blast-furnace practice in recent years have increased the efficiency of the process. These include oxygen enrichment of the blast, introduction under pressure of supplemental fuel (oil, gas, coke, etc.) through the tuyeres, operation under greater top pressure, and utilization of iron ore pellets. The growing use of iron ore pellets has had a marked effect on the efficiency and capacity of blast furnaces. The specially "manufactured" iron ore pellets--uniform in chemical composition, size, and physical structure and high in iron content--have increased both the quantity and quality of blast-furnace output and facilitated the control of the operations.

The effect of these recent advancements in blast-furnace operating techniques on average daily production of pig iron is illustrated by the following data assembled by the American Iron and Steel Institute for selected years since 1955:

	Blast-furnace days (number)	Pig iron production per blast-furnace day (long tons)
1955	82,064	836.2
1958	53,611	951.9
1961	49,511	1,165.5
1964	59,301	1,287.8
1965	61,416	1,282.1
1966	61,459	1,329.3

Average production per blast-furnace day increased by almost 60 percent from 1955 to 1966. Since few new furnaces were built during that period, the increase largely reflects the adaptation of existing furnaces to modern techniques. Further evidence of the improved production techniques is the decline in consumption of the basic raw materials (ore, scrap, scale, flux, and coke) per ton of pig iron produced, the aggregate total decreasing from 2.788 tons in 1955 to 2.276 tons in 1965.

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The trend of annual production of merchant pig iron has not paralleled the trend of total pig iron production noted above. At least 70 percent of the annual output of merchant pig iron generally consists of foundry and malleable grades and only 15 to 20 percent of basic grade, whereas 90 percent of total pig iron production is of basic grade, which grade accounted for the entire increase in such production from 1958 to 1965. Producers' shipments of merchant pig iron, by grades, in 1958 and 1961-66 were as follows (in thousands of long tons): 1/

Grade	1958	1961	1964	1965	1966
Basic	459	812	469	654	566
Malleable	1,745	1,705	1,611	1,741	1,778
Foundry	1,073	620	875	720	710
Other	365	334	338	361	284
Total	3,642	3,471	3,293	3,476	3,338

According to the U.S. Department of the Interior, the average value of shipments of pig iron, including producers' captive transfers of hot metal, declined almost steadily from a peak of $66.75 per ton in 1958 to $63.85 in 1965. The composite prices computed periodically by Iron Age, which figures are believed to be more representative of the level and trend of prices of merchant pig iron than are the average unit values of shipments, declined from an average of $66.45 per ton in 1958 to $63.11 in December 1966.

U.S. exports

Exports of domestically produced pig iron, which generally fluctuate from year to year, have been very much smaller than imports during the past decade, except in 1957 and 1961. Exports declined from a postwar high of 784,000 tons in 1957 to 92,000 tons in 1958, and to 9,000 tons in 1959. The fact that most U.S. blast furnaces were shut down for 116 days in the second half of 1959 owing to a management-labor dispute accounted in large measure for the low level of exports in that year. In 1961, U.S. exports amounted to 371,000 tons, and in 1964-66 they ranged between 11,000 and 157,000 tons (table 1). The annual fluctuations in exports are attributable in part to U.S. Government assistance to developing countries. The 1964 exports to Pakistan, for example, were financed by a program of the U.S. Agency for International Development. Exports in 1958 and 1964-66, by principal markets, are shown in table 2.

1/ Data, from the American Iron and Steel Institute, relate to shipments to others by all producers, including those that consume most of their own production.

U.S. exports of pig iron are believed to consist predominantly of foundry and malleable grades. The unit value of the exports in 1966 averaged $67.58 per ton, but varied widely, depending on the foreign market. Exports to Ghana averaged about $58 per ton, and those to Canada, about $76.

U.S. imports

As already indicated, the United States is generally a substantial net importer of pig iron. Since 1958, imports have trended upward but did not rise above the 1951 level of 951,000 tons until 1966, when they amounted to 1,060,000 tons. Imports, consisting almost entirely of the type of pig iron and cast iron classifiable under item 607.15, 1/ have continued to constitute only about 1 percent of annual U.S. consumption of all pig iron. The ratio of imports to apparent consumption of merchant pig iron, however, increased from about 4 percent in 1958 to nearly 19 percent in 1965 and to 24 percent in 1966.

For many years Canada has been the leading supplier of U.S. imports of pig iron (table 3). Canada's share of U.S. imports, although declining in recent years, exceeded 50 percent each year until 1966. Since 1959, West Germany, the Republic of South Africa, and Spain have also been consistent suppliers, and since 1964 some of the countries and areas designated as Communist in general headnote 3(e) to the TSUS (see section on U.S. tariff treatment) have become substantial suppliers. In 1966, when 32 percent of U.S. imports of pig iron came from Canada, 33 percent came from Communist countries (viz, the U.S.S.R., East Germany, Czechoslovakia, and Romania).

The average value per ton of pig iron imported from all sources declined from $64.29 in 1958 to $43.33 in 1966. The unit value of pig iron imported from Canada, which in 1958 approximated the U.S. composite price of $66.45 per ton (see discussion on U.S. production), was $56.32 in 1966, or about 11 percent below the domestic price. The average unit values of imports from other sources in 1966 were as much as 40 percent below that of the imports from Canada.

During 1966, 40 percent of U.S. imports of pig iron entered through the customs districts bordering the Great Lakes. The imports

1/ In 1966, imports under item 607.18 amounted to 1,653 tons, valued at $372,000, of which 1,601 tons, valued at $366,000, were entered duty free; see section on U.S. tariff treatment.

entered through the lake ports, which included about three-fourths of the pig iron imported from Canada and nearly a quarter of that from overseas, were probably consumed in plants near the ports of entry. About 29 percent of the 1966 imports entered through the Philadelphia customs district (which includes southeastern Pennsylvania, southern New Jersey, and Delaware), and 18 percent through the customs districts bordering the Gulf of Mexico, principally Mobile, Ala. The bulk of the pig and cast iron imported through the Philadelphia and Mobile districts was consumed by producers of pipe and foundry products situated within or adjacent to those districts.

World production

World production of pig iron increased by 71 percent from 1958 to 1965. In that period the annual output of Japan rose by a greater percentage than that of any other major producing country. Although pig iron is reported to be produced in some 42 countries, the 11 listed in table 4 have consistently accounted for about four-fifths of the annual world total. The United States accounts for about a fourth of the annual world output of pig iron, while the U.S.S.R. produces a fifth.

Table 1.--Pig iron and cast iron: U.S. production, imports, exports, and consumption, 1958-66

Year	Production 1/	Imports	Exports	Reported consumption
	Quantity (1,000 long tons)			
1958	51,031	187	92	51,127
1959	53,759	625	9	55,155
1960	59,376	295	100	59,488
1961	57,904	337	371	58,748
1962	58,605	446	138	59,460
1963	64,143	576	63	64,901
1964	76,367	658	157	77,127
1965	78,756	788	25	79,415
1966	81,704	1,060	11	81,937
	Value (1,000 dollars)			
1958	3,406,330	12,040	6,725	2/
1959	3,572,285	35,490	549	2/
1960	3,957,410	18,351	5,174	2/
1961	3,795,028	20,511	19,243	2/
1962	3,816,970	24,682	8,283	2/
1963	4,200,462	28,940	4,479	2/
1964	4,982,156	31,591	10,275	2/
1965	5,028,590	38,438	1,665	2/
1966	2/	45,914	731	2/

1/ Value estimated on the basis of the average value of shipments as reported by the U.S. Department of the Interior.
2/ Not available.

Source: Production and consumption compiled from official statistics of the U.S. Department of the Interior, except as noted; imports and exports compiled from official statistics of the U.S. Department of Commerce.

Table 2.--Pig iron: U.S. exports of domestic merchandise, by principal markets, 1958 and 1964-66

Country	1958	1964	1965	1966
	Quantity (long tons)			
South Viet-Nam 1/	-	39	1,731	3,957
Canada	1,427	1,129	1,533	2,376
Pakistan	-	92,184	19,528	1,672
Mexico	-	546	1,248	1,235
India	48,220	2,478	380	-
All other	2/ 42,628	3/ 60,817	781	1,583
Total	92,275	157,193	25,201	10,823
	Value (1,000 dollars)			
South Viet-Nam 1/	-	3	127	241
Canada	106	84	118	181
Pakistan	-	7,171	1,242	122
Mexico	-	39	95	87
India	3,654	209	28	-
All other	2/ 2,965	3/ 2,769	55	100
Total	6,725	10,275	1,665	731

1/ In the U.S. statistics, trade with South Viet-Nam was separately reported beginning in 1966.

2/ Includes 14,424 tons, valued at 1,073 thousand dollars, to Italy; 12,011 tons, valued at 853 thousand dollars, to Belgium and Luxembourg; 4,638 tons, valued at 308 thousand dollars, to the Philippine Republic; 4,401 tons, valued at 295 thousand dollars, to West Germany; and 3,500 tons, valued at 202 thousand dollars, to Cuba.

3/ Includes 53,229 tons, valued at 2,346 thousand dollars, to Japan, and 7,204 tons, valued at 396 thousand dollars, to Taiwan.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Pig iron and cast iron: U.S. imports for consumption, by principal sources, 1958, 1959, and 1964-66

Country	1958	1959	1964	1965	1966
	Quantity (long tons)				
Canada	162,614	390,264	352,859	433,115	341,422
Finland	-	9,154	65,182	59,305	57,728
Republic of South Africa 1/	-	62,963	61,268	11,489	119,486
Brazil	2	-	60,621	65,658	-
West Germany	12,440	38,595	45,904	57,339	71,205
East Germany	-	98	51,055	73,472	93,653
Spain	7,024	70,088	10,431	37,576	8,038
All other	5,191	55,371	10,244	49,631	2/ 358,057
Total	187,271	626,533	657,564	787,585	1,059,589
	Value (1,000 dollars)				
Canada	10,683	24,747	19,345	24,063	19,793
Finland	-	465	2,713	2,423	2,293
Republic of South Africa 1/	-	2,507	2,684	489	4,723
Brazil	3	-	2,190	2,270	-
West Germany	656	1,810	1,919	2,465	3,023
East Germany	-	4	1,835	2,727	3,236
Spain	371	3,347	438	1,601	272
All other	327	2,713	467	2,400	2/ 12,574
Total	12,040	35,593	31,591	38,438	45,914
	Unit value (per long ton)				
Canada	$65.70	$63.41	$54.82	$55.56	$56.32
Finland	-	50.77	41.62	40.85	39.73
Republic of South Africa 1/	-	39.82	43.81	42.55	39.53
Brazil	3/	-	36.12	34.58	-
West Germany	52.70	46.88	41.81	46.84	42.46
East Germany	-	40.82	35.94	37.12	34.56
Spain	52.89	47.76	41.97	42.61	33.82
All other	62.99	49.00	45.59	48.36	2/ 35.12
Average	64.29	56.80	48.04	48.80	43.33

1/ Name changed from Union of South Africa on May 31, 1961.

2/ Includes 165,530 tons, valued at 5,567 thousand dollars ($33.63 per ton), imported from the U.S.S.R.; 64,879 tons, valued at 2,319 thousand dollars ($35.74 per ton), imported from Rhodesia; and 60,686 tons, valued at 2,218 thousand dollars ($36.54 per ton), imported from Czechoslovakia.

3/ Not representative.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 4.--Pig iron: 1/ World production by selected countries, 1958, 1961, and 1965

Country	1958	1961	1965
	Quantity (1,000 long tons)		
United States	52,559	59,569	81,264
U.S.S.R	39,018	50,089	65,194
European Economic Community:			
West Germany	16,396	25,029	26,563
France	11,947	14,618	15,762
Belgium	5,432	6,343	8,310
Italy	2,132	3,150	5,629
Luxembourg	3,233	3,773	4,079
Netherlands	903	1,434	2,327
Japan	7,598	16,124	27,715
Mainland China	9,348	14,732	18,660
United Kingdom	12,974	14,747	17,460
Total, listed countries	161,540	209,608	272,963
All other	31,942	42,660	57,452
World total	193,482	252,268	330,415
	Percent of total		
United States	27	24	25
U.S.S.R	20	20	20
European Economic Community:			
West Germany	8	10	8
France	6	6	5
Belgium	3	3	3
Italy	1	1	2
Luxembourg	2	1	1
Netherlands	2/	1	1
Japan	4	6	8
Mainland China	5	6	6
United Kingdom	7	6	5
Total, listed countries 3/	83	83	83
All other	17	17	17
World total	100	100	100

1/ Includes ferroalloys; however, the production of ferroalloys probably accounts for only 1 to 3 percent of the total.
2/ Less than 0.5 percent.
3/ Because of rounding, figures may not add to the totals shown.

Source: Compiled from official statistics of the U.S. Department of the Interior.

Commodity	TSUS item
Sponge iron and powders thereof	608.02, -.04
Other iron or steel powders	608.05, -.06, -.08

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

U.S. consumption of iron and steel powders was about 3½ times as large in 1966 as in 1958. Although more than half of the facilities in the United States for producing sponge iron and powder are foreign owned, imports of sponge iron and of iron and steel powders have always supplied a significant share of annual U.S. requirements--in 1965-66, about three-tenths. Exports were larger in 1966 than in previous years, but were about one-sixth as large as imports in that year.

Description and uses

Sponge iron is a porous spongelike material generally in the form of a cake and usually containing 96 percent or more of iron, the remainder being largely of carbon. In the United States sponge iron is produced principally by reducing uniform high-grade iron ore with coke at temperatures well below the melting point of iron. Sponge-iron powder, a virtually pure, finely divided, iron containing as much as 98.5 to more than 99 percent by weight of iron, is produced by pulverization of the sponge-iron cake. The pulverized iron is annealed in a hydrogen atmosphere to eliminate the effects of the cold working (pulverizing) and also to further reduce the content of carbon and oxygen.

Sponge iron is also produced by the atomization of molten cast iron or steel scrap of carefully selected analysis. The atomization introduces oxygen into the material; however, the oxygen, as well as the carbon contained in the scrap, can be minimized by heat treatment. The heat treatment results in a cake of sponge iron which is converted to sponge-iron powder by milling.

"Other" iron or steel powders (items 608.05 to 608.08) are produced by reducing selected mill scale (and to a lesser extent, other ferrous materials) with hydrogen or coke, by electrolysis and by the carbonyl process. In the electrolytic process, brittle iron of very

high purity is deposited on the cathode. After the iron is stripped from the cathode, it is converted to powder in ball mills and then annealed. In the carbonyl process, a crude iron powder (often sponge-iron powder) is usually reacted with carbon monoxide; the resulting gas is then decomposed to recover the iron. Such iron powders are of very high purity, usually very fine, and approximately spherical in shape; some are chemically pure (see headnote 1 to part 2 of schedule 6).

The bulk of the so-called iron powders contain a small percentage of carbon--possibly 0.04 to 0.06 percent. In this respect these powders are similar to certain low-carbon steels. As in steel, the carbon content of the powder has a direct effect on the hardness of the powder; within limits, the greater the carbon content, the harder the product. Carbon in the form of graphite is frequently mixed with an iron powder for the purpose of introducing certain physical properties.

Alloy powder can be made by mechanically mixing iron powder (as described previously) with appropriate proportions of powders of other metals. Alloy powders are also produced by atomizing the melted alloy itself with subsequent milling and heat treatment. The latter process is very common in the production of high-alloy powders, such as stainless steel powders (item 608.06). In recent years the great bulk of the sponge iron used in the United States has been in the production of powders; the amount used as melting stock in electric furnaces in the production of high-quality steels has declined.

Almost two-thirds of the quantity of iron and steel powder consumed in the United States is used in the production of parts for machines and other equipment by powder metallurgy techniques. The manufacture of a gear by powder metallurgy methods eliminates as many as seven separate machining operations required by other methods of production. 1/ A current model of a popular copying machine has 52 component parts made from metal powder, and the average domestically produced automobile contains 8 to 10 pounds of parts produced from metal powder. Many kinds of metal powder are used for these parts but iron powder predominates; see summaries in volumes 6:1, 6:2, and 6:3 relating to powders of other metals (items 612.56, 618.40, 620.32, 622.35, 624.40, 624.42, and 629.28).

Iron or steel powder is used in substantial volume for coating welding rod. A rather thick coating of a mixture of iron powder and

1/ In the powder metallurgy process, the powder is compressed in a die roughly the shape and size of the finished article. The "compact" is removed from the die and sintered. The article is then compressed in a "coining" or sizing die, which reduces it to its final dimensions and also improves certain physical characteristics of the metal.

fluxing material has been found to result in better and faster welds. When iron powder is introduced into the flame of oxyacetylene torches, it greatly increases the temperature of the flame, thus hastening the cutting process. Iron powders, particularly electrolytic and carbonyl powders, are also used in electric contacts, in electronic circuits, and in applications where their magnetic properties are desired (e.g., in the production of magnetic inks, in cleaning seeds, and in testing steel for flaws). Extremely fine iron powder of high purity is used to enrich the iron content of certain foodstuffs and pharmaceuticals. New uses are continuously being developed.

In this summary all quantities are given in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty (see general headnote 3 in appendix A) applicable to imports are as follows:

TSUS item	Commodity	Rate of duty
	Sponge iron and powders thereof:	
608.02	Containing by weight not over 0.2 percent of chromium, 0.1 percent of either molybdenum or vanadium, or 0.3 percent of tungsten.	62.5¢ per long ton. 1/
608.04	Other	62.5¢ per long ton 1/ + additional duties. 2/
	Other iron or steel powders:	
608.05	Other than alloy	0.3¢ per lb.
	Alloy:	
608.06	Stainless steel powders	0.3¢ per lb.
608.08	Other	19% ad val.

1/ Equivalent to approximately 0.0279 cents per pound.
2/ As provided under items 607.01 to 607.04 (see appendix A).

These tariff rates, based on or derived from the rates previously applicable to the principal imports here considered, reflect concessions granted by the United States in the General Agreement on Tariffs and Trade. The rate of 62.5 cents per ton applicable to sponge iron and sponge-iron powders (items 608.02 and 608.04), in effect since April 30, 1950, was provided for in paragraph 301 of the former tariff schedules; it was bound against increase in a supplemental bilateral trade agreement with Venezuela, effective October 11, 1952. The rate of 0.3 cents per pound applicable to other powders of unalloyed iron and steel and of stainless steel (items 608.05 and 608.06) is the same

as the rate that became effective on July 1, 1963, for "sand of iron or steel" under paragraph 335. The pre-TSUS imports entered as "sand," an obsolete term, consisted of powders of unalloyed or stainless steel. The rate of 19 percent for powders of alloy steel other than stainless steel (item 608.08) is the estimated average of the various rates formerly applicable to such powders, and is the same as the rate applicable since June 30, 1958, to powders in chief value of iron or steel under paragraph 397. Chemically pure iron powders, which are now dutiable under item 608.05, were dutiable at 10.5 percent under paragraph 5 of the pre-TSUS schedules (CD 756).

The ad valorem equivalents of the specific rates of duty shown above, based on imports entered during 1966, were as follows:

TSUS item	Percent
608.02	0.5
608.04	1/ .6
608.05	1.0
608.06	.7

1/ Computed without regard to the additional cumulative duties under items 607.01 to 607.04; see general statement on the provisions of subpart 2B of schedule 6.

U.S. consumption

Annual U.S. consumption of iron and steel powders increased from about 33,000 short tons in 1958 to about 100,000 tons in 1965, and to 115,000 tons in 1966 (table 1). Most of the growth in consumption can be attributed to the increased use of iron powder in the fabrication of component parts by powder metallurgy techniques.

Of the total consumption of iron or steel powder in the United States in 1966, about 58 percent was used in the production of component parts of machines and other articles. About 50 to 60 percent of the powder so used went into parts for motor vehicles, and the remainder, into parts for appliances, guns, cash registers, office machines, copying machines, and other industrial and consumer goods. Between 20 and 25 percent of the iron or steel powder used in recent years has been for coating welding electrodes, whereas 7 to 10 percent has been for flame cutting, and the remainder, for magnetic, electronic, and miscellaneous applications.

With the anticipated growth in the annual output of virtually all the articles that are now being produced in part by powder metallurgy techniques, as well as the tendency to use such techniques for an

increasing range of articles, it is likely that annual consumption of iron powder will continue to rise significantly for some years to come. Projections by some industry spokesmen suggest that U.S. consumption of iron or steel powder may be twice as high in 1970 as in 1965. At present nearly all the industrial consumers of iron or steel powder are concentrated in the Northeast quadrant of the United States.

U.S. producers

There are about 10 domestic producers of sponge iron and iron or steel powders. In response to the wide acceptance of the powder metallurgy principle of production and the continuing development of new uses for iron or steel powders, the producers have been enlarging their production facilities in recent years. Some of the producers also manufacture nonferrous metals in powder and other forms, as well as pigments, paints, and other products. Only a few producers of iron or steel powders, however, consume such powders in the production of finished products; none are fabricators of parts for motor vehicles, appliances, machines, and other industrial or consumer goods.

One company, by far the largest U.S. producer of sponge iron and iron or steel powders, produces only the products covered by this summary; it probably accounts for more than half of the annual domestic output of these products. Most of the concerns that make sponge iron produce it only as an intermediate step in the production of powders. It is understood that a few concerns that produce carbonyl and electrolytic iron powders utilize sponge iron purchased from others.

A number of the U.S. producers, including the largest, are subsidiaries of foreign concerns; they account for well over half of the annual U.S. output. Except in unusual circumstances, powders sold in the U.S. market by these concerns are products of domestic plants. Another producing facility controlled by foreign interests is expected to begin operations in the United States by the end of 1967.

U.S. production and exports

Annual data on U.S. production (or on shipments by domestic producers) comparable to those on imports are not separately reported. On the basis of available data on consumption and foreign trade, however, it appears that domestic production of iron or steel powders, estimated at 27,000 to 32,000 tons in 1958, increased to about 85,000 to 90,000 tons in 1966. With completion of current expansion programs at established plants and the anticipated operation of at least two new powder-producing facilities, annual domestic output will be substantially larger in the near future than in 1966.

Prior to 1965, export data were separately reported for iron or steel powders, but not for sponge iron. During 1958-64, U.S. exports of such powders increased almost without interruption from 204 tons in 1958 to 1,260 tons in 1964. Aggregate exports of powders and sponge iron amounted to 5,165 tons in 1965 and to 5,623 tons in 1966 (table 2). In 1966, exports to France, Italy, West Germany, and Japan probably consisted largely of powders, whereas exports to Canada, Brazil, Argentina, and Sweden were principally of sponge iron.

Because of the susceptibility of iron or steel powders to oxidation, special packaging is required for shipment to both domestic and foreign customers. These powders are shipped in extra heavy paper bags having a moisture barrier or in fiber or steel drums containing a drying agent. Upon request, producers usually recondition powder that has become oxidized after extended storage by a consumer. Although producers' prices vary somewhat, customer service and powder performance are more important competitive factors than price.

U.S. imports

Annual U.S. imports of sponge iron and iron or steel powders during 1958-62 fluctuated between 4,738 short tons (in 1961) and 9,056 tons (in 1959). Thereafter, largely because of surging demand in the United States for such powders, imports increased sharply and amounted to about 32,000 tons in each of the years 1965 and 1966 (table 1). In 1964-66, imports of sponge iron and sponge-iron powder (items 608.02 and 608.04) accounted for nearly all of the annual imports of the products covered by this summary (table 3).

Sweden has long been a major source of sponge iron and sponge-iron powder. Before the establishment in 1953 of the major domestic facility for producing these products, imports from Sweden had constituted a very large part of the annual U.S. supply. During 1960-62, domestic production rose and imports supplied only a tenth of the U.S. requirements. In more recent years the United States has again become increasingly dependent on imports for a substantial part of its growing annual requirements; imports supplied about three-tenths of total U.S. consumption in 1965 and 1966.

With the completion of new and expanded powder-producing facilities in the United States, especially those of producers that are subsidiaries of foreign concerns, imports may again decline, both absolutely and in relation to domestic consumption. It is likely, however, that as long as annual consumption continues to increase as it has in the past few years, imports will continue to be a significant factor in the total U.S. supply.

Imports from Sweden of sponge iron and sponge-iron powder (608.02 and 608.04) are believed to consist about equally of sponge iron and sponge-iron powder. The bulk of the imports from Canada, recently another important source of the imports under item 608.02, are believed to consist of powder rather than sponge iron. Sweden and Canada, along with West Germany, France, Italy, and the United Kingdom, are also among the major sources of the other iron or steel powders discussed here (table 4).

Table 1.--Sponge iron and iron and steel powders: U.S. consumption and imports for consumption, 1958-66

Year	Consumption	Imports 1/		Ratio of imports to consumption
		Quantity	Value	
	Short tons	Short tons	1,000 dollars	Percent
1958	33,000	6,264	791	19
1959	48,000	9,056	1,171	19
1960	49,000	5,141	775	10
1961	49,000	4,738	832	10
1962	63,000	6,136	1,065	10
1963	69,000	11,297	1,623	16
1964	85,000	13,512	2,140	16
1965	100,000	31,937	4,508	32
1966	115,000	31,796	4,504	27

1/ Data for 1958-63 are partly estimated.

Source: Imports compiled from official statistics of the U.S. Department of Commerce, except as noted; consumption as reported by the Metal Powder Industries Federation.

Note.--Data on production are not separately reported. On the basis of foreign trade and consumption, annual U.S. production is estimated to have increased from about 27,000 tons in 1958 to about 90,000 tons in 1966. Comparable data on exports are available only for 1965 and 1966 (see table 2).

Table 2.--Iron and steel powders and sponge iron: U.S. exports of domestic merchandise, by principal markets, 1965 and 1966

Market	1965		1966	
	Quantity	Value	Quantity	Value
	Short tons	1,000 dollars	Short tons	1,000 dollars
Canada	1,984	463	1,481	352
Japan	295	125	489	168
Brazil	414	71	640	114
France	33	48	95	73
Argentina	483	84	393	72
Mexico	293	63	219	71
Italy	62	40	57	70
Sweden	109	21	316	54
Nansei and Nanpo Islands	-	-	280	54
United Kingdom	216	55	199	50
Colombia	-	-	191	48
West Germany	22	46	25	46
All other	1,254	327	1,238	290
Total	5,165	1,343	5,623	1,462

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Sponge iron and iron and steel powders: U.S. imports for consumption, by TSUS item number, 1964-66

TSUS item	1964	1965	1966
	Quantity (short tons)		
608.02	7,609	17,127	9,653
608.04	4,865	13,147	21,003
608.05	1,017	1,595	2,113
608.06	13	67	21
608.08	8	1	6
Total	13,512	31,937	31,796
	Value (1,000 dollars)		
608.02	726	1,863	1,116
608.04	772	1,762	2,111
608.05	619	835	1,258
608.06	20	44	17
608.08	3	4	2
Total	2,140	4,508	4,504

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Sponge iron and iron and steel powders: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Sweden	7,995	24,191	20,771
Canada	4,437	6,509	9,293
West Germany	65	467	537
France	121	194	258
Italy	226	258	365
United Kingdom	167	134	148
All other	501	184	424
Total	13,512	31,937	31,796
	Value (1,000 dollars)		
Sweden	1,190	3,008	2,498
Canada	425	774	896
West Germany	82	204	407
France	153	237	316
Italy	95	106	147
United Kingdom	181	102	88
All other	14	77	152
Total	2,140	4,508	4,504

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Grit and shot, including wire pellets, of iron or steel	608.10

Note.--For the statutory description of each item, see the Tariff Schedules of the United States (pertinent provisions thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on page 23.

U.S. trade position

The rising annual U.S. requirements for grit, shot, and wire pellets, of iron or steel have been supplied almost entirely by domestic producers. Exports, which more than tripled in quantity from 1958 to 1966, took 8 percent of the 1966 domestic output. Imports, which have also been rising in recent years, were equivalent in 1966 to about 1 percent of the quantity of apparent consumption.

Description and uses

Shot of iron or steel is manufactured by dividing molten metal--usually by centrifugal force--into small, random-size spherical globules and chilling them in water. After cooling, the shot is sorted into various sizes and grades. The term "shot" used in item 608.10 does not include ammunition, such as "BB" shot for use in air rifles and pistols. Grit usually consists of shot crushed into irregular, angular shapes, whereas wire pellets are normally manufactured by cutting dead-cast wire of high-carbon steel into pieces roughly as long as the diameter of the wire.

Iron or steel grit, shot, and wire pellets, the most common of the metallic abrasives, are used in manufacturing to finish, deburr, descale, and polish metal articles and to deflash rubber and plastic articles. Other products, both metallic and nonmetallic, are used for the same purposes, but the metallic abrasives considered here are generally more resistant to wear and fracture than most other common abrasives (viz, glass beads, corn cobs, crushed nut shells, and stones). Despite their durability, however, grit, shot, and wire pellets of iron or steel are eventually reduced to dust.

Shot of iron or steel is, by far, the most common metallic abrasive in general use and as a rule, is less expensive than grit. Shot can be used for most cleaning and finishing operations and for peening--a process used to improve or alter surface characteristics of metal

parts or products. Grit is generally used only in descaling operations. Wire pellets generally have the same uses as grit and shot but are harder and more wear resistant. Wire pellets to be used for simple cleaning of castings or descaling can be produced from steel having a moderate carbon content.

Grit, shot, and wire pellets are generally used in machines which blast them at the article to be processed. Usually the abrasive is propelled by jets of air or by centrifugal force; extremely small particles, however, must be carried by jets of water. The machines vary in size according to the types of articles to be processed, some being large enough to process a whole railroad boxcar. Some articles, particularly iron castings, are cleaned by inserting them into a tumbling device with metallic or other abrasives.

U.S. tariff treatment

The current column 1 rate of duty (see general headnote 3 in appendix A) applicable to imports is as follows:

TSUS item	Commodity	Rate of duty
608.10	Grit and shot, including wire pellets, of iron or steel	0.3¢ per lb.

This rate, which is the same as that provided under paragraph 335 of the former tariff schedules, became effective on July 1, 1963, and reflects a concession granted by the United States in the General Agreement on Tariffs and Trade (GATT). The GATT concession became operative in two annual stages, the first on July 1, 1962.

Based on imports during 1966, the ad valorem equivalent of the current rate is 4.7 percent.

U.S. consumption, production, and exports

The trend of apparent annual U.S. consumption of grit, shot, and wire pellets of iron or steel has been markedly upward in recent years. Estimated annual consumption, consisting almost entirely of domestic production, rose from about 197 million pounds in 1958 to 377 million pounds in 1966, or by 91 percent (table 1).

Grit, shot, and wire pellets of iron or steel are produced by probably not more than 10 U.S. concerns, most of which are in the Northeast. The largest producing concerns are in Maryland and Indiana; 4 are in Ohio and 1 is in Texas. Domestic producers' competitive

advantage over foreign producers in the U.S. market is derived mainly from proximity to customers and to a greater supply of scrap metal, the principal material from which grit and shot are produced.

In recent years annual domestic production of the products considered here, which has risen even more markedly than annual consumption, increased from 205 million pounds in 1958 to 403 million pounds in 1966, or by 97 percent. In the period 1958-66, annual exports increased both in absolute amounts and in relation to production. Exports amounted to 9 million pounds (about 5 percent of production) in 1958 and rose to nearly 31 million pounds (about 8 percent of production) in 1966.

In recent years Canada, Mexico, and France have been the principal markets for U.S. exports of iron or steel grit, shot, and wire pellets (table 2). Canada took 72 percent of total U.S. exports of these products in the 2-year period 1965-66.

U.S. imports

During 1958-63 annual U.S. imports of grit, shot, and wire pellets of iron or steel ranged between 2.0 million pounds (in 1958) and 3.8 million pounds (in 1959). Thereafter they increased each year, reaching 4.8 million pounds in 1966. Despite this recent rise, annual imports have continued to supply only 1 to 2 percent of annual consumption.

Japan, the United Kingdom, France, and Canada have been the principal sources of imports in recent years (table 3). The reported value 1/ of the 1966 imports from the United Kingdom averaged 4 cents a pound, and that of the corresponding imports from Japan and France, 8 cents a pound. The average value of the small imports from Switzerland was slightly more than $2 a pound.

1/ Generally the market value in the foreign country; therefore it excludes U.S. import duties, freight, and transportation insurance.

Table 1.--Grit and shot (including wire pellets) of iron or steel: U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

(Quantity in thousands of pounds; value in thousands of dollars)

Year	Production	Imports	Exports 1/	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1958	204,670	2,023	9,343	197,350	1
1959	250,356	3,775	10,392	243,739	2
1960	223,578	2,608	10,458	215,728	1
1961	221,758	2,706	12,383	212,081	1
1962	257,082	3,159	12,659	247,582	1
1963	261,848	2,778	11,630	252,996	1
1964	311,262	3,576	13,832	301,006	1
1965	371,150	4,427	22,202	353,315	1
1966	403,100	4,774	30,631	377,243	1
	Value				
1958	13,634	330	817	13,147	3
1959	17,932	570	997	17,505	3
1960	15,909	538	1,004	15,443	3
1961	15,356	577	1,023	14,910	4
1962	17,955	731	1,008	17,678	4
1963	18,148	516	929	17,735	3
1964	21,800	223	1,124	20,900	1
1965	25,911	314	1,923	24,302	1
1966	25,272	325	2,764	22,833	1

1/ Data for 1958-64 estimated.

Source: Production from official statistics of the U.S. Department of the Interior; imports and exports from official statistics of the U.S. Department of Commerce, except as noted.

Table 2.--Grit and shot (including wire pellets) of iron or steel: U.S. exports of domestic merchandise by principal markets, 1965 and 1966

Market	1965		1966	
	Quantity	Value	Quantity	Value
	1,000 pounds	1,000 dollars	1,000 pounds	1,000 dollars
Canada	14,561	1,219	23,399	2,094
Mexico	2,656	262	2,012	184
France	459	40	1,106	88
Netherlands	654	50	744	56
Venezuela	195	28	514	54
United Kingdom	422	40	454	47
West Germany	438	35	169	14
Argentina	464	50	-	-
All other	2,353	199	2,233	227
Total	22,202	1,923	30,631	2,764

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Grit and shot (including wire pellets), of iron or steel: U.S. imports for consumption by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (1,000 pounds)		
Japan	659	1,751	2,246
United Kingdom	1,658	1,407	1,560
France	72	833	490
Canada	521	380	431
All other	666	56	47
Total	3,576	4,427	4,774
	Value (1,000 dollars)		
Japan	30	130	183
United Kingdom	79	54	64
France	9	68	39
Canada	15	41	30
All other	90	21	9
Total	223	314	325

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Ingots, blooms, billets, slabs, and sheet bars:	
Other than alloy iron or steel	608.15, -.16
Alloy iron or steel	608.18

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

The United States is the world's largest consumer and producer of steel, of which ingots, blooms, billets, slabs, and sheet bars are primary forms. Despite their bulk, substantial quantities of these products enter the international trade of the United States, although neither exports nor imports amount to as much as 1 percent of total domestic consumption.

Description and uses

In this summary and elsewhere in this volume the term "raw steel" is used to refer to steel in its first solid state suitable for processing or for sale. By far the major use of molten steel is for the production of ingots, which are then converted, principally by rolling, into the semifinished forms in this summary and eventually into more advanced products. Substantial quantities of the semifinished products considered here are advanced in condition by the foundry and forging industries. Although more than a century old in concept, the continuous process for casting molten steel directly into slabs or billets has only recently been perfected and widely adopted both in the United States and abroad. Some molten steel is cast directly into railcar wheels and components of railroad equipment and other machinery.

Raw steel is produced by several processes; currently the most important in the United States are the open-hearth, basic-oxygen, and electric processes. The principal iron-bearing materials consumed by these steelmaking processes are pig iron and scrap, but in various

proportions. The following tabulation shows the percentages of pig iron and scrap that were consumed in the United States in 1966 by each type of furnace:

Type of furnace	Pig iron	Scrap
Open-hearth	59	41
Basic-oxygen	71	29
Electric	2	98
Bessemer	98	2

In contrast to the continuous operation of the blast furnaces used to make pig iron, all steelmaking furnaces operate on a "batch" (heat) cycle. The molten steel from a particular heat is tapped into a ladle and then poured ("teemed") into ingot molds. After the exterior of the ingot has solidified sufficiently, the ingot mold is removed and the ingot is placed in a furnace, commonly known as soaking pit, where it remains at least until the temperature necessary for rolling or forging is equalized throughout the ingot. Frequently, "soaked" ingots are rolled without intermediate reheating through various semifinished stages and to finished products. This practice is particularly common in the production of heavy structural shapes, rails, and heavy plates. Small ingots remain sufficiently plastic after soaking to be rolled continuously into finished merchant bars or rods. Some ingots, of course, are allowed to cool fully for shipment to other plants or for reheating and rolling at a later time. Most ingots, however, are rolled into blooms, slabs, or billets, allowed to cool, and subsequently reheated and further worked (in the same plant) by rolling or forging.

Ingots.--Ingots are defined in headnote 3(a) to subpart 2B of schedule 6 as "castings resulting from the solidification of molten steel and having a columnar form suitable for working by rolling or forging." Ingots vary widely in size and may have smooth, corrugated, or fluted sides. They are usually tapered from one end to the other, a shape that facilitates removal of the mold when the exterior of the ingot has solidified; ingot molds (item 674.10) are discussed in a separate summary in volume 6:9.

Blooms, billets, slabs, and sheet bars.--The terms "blooms," "billets," "slabs," and "sheet bars" have never had a precise meaning in the iron and steel industry. They are used to denote the semifinished or primary forms of steel resulting from the initial stages of processing steel in the manufacture of bars, rods, plates, sheets, structural shapes, and other products. Although the great bulk of these forms are produced by hot-rolling ingots, they may also be produced by casting or forging. Blooms, billets, slabs, and sheet bars differ primarily in size. As stated in headnote 3 to part 2B of schedule 6 of the TSUS, blooms and billets are "generally of rectangular or

circular cross section, having a length several times greater than the maximum cross-sectional dimension, and, if rectangular, a width less than 4 times the thickness. A bloom is at least 36 square inches in cross-sectional area; a billet is less than 36 square inches but not less than 3 square inches in cross-sectional area." Blooms and billets are very often square. In the trade, billets of circular cross section intended to be used in the production of seamless tubes are often referred to as tube rounds. Slabs and sheet bars, which are flatter than blooms or billets are "of rectangular cross section, having a width of at least 4 times the thickness. A slab is not less than 2 inches and not over 6 inches in thickness; a sheet bar is less than 2 inches in thickness."

Blooms, billets, slabs, and sheet bars require conditioning during or after rolling. Conditioning refers to a number of means by which surface imperfections and other defects of the semifinished product are corrected or eliminated before further rolling. Inasmuch as it is not practical to attempt to correct all imperfections, the extent of conditioning depends largely on the quality required in the finished product. In general, slabs are used to produce flat-rolled products such as plates, sheets, and strip, while billets are used in the production of structural and light shapes, bars, and rods. Billets, however, are sometimes used to produce narrow strip.

In this summary all quantities are expressed in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty (see general headnote 3 in appendix A) applicable to imports are as follows:

TSUS item	Commodity	Rate of duty
	Ingots, blooms, billets, slabs, and sheet bars:	
	Other than alloy iron or steel:	
608.15	Valued not over 5 cents per pound	8.5% ad val.
608.16	Valued over 5 cents per pound	10.5% ad val.
608.18	Alloy iron or steel	14.5% ad val. + additional duties. 1/

1/ As provided under items 607.01 to 607.04 (see appendix A).

These rates, derived principally from rates that became effective on June 30, 1958, reflect concessions granted by the United States in the General Agreement on Tariffs and Trade. In the pre-TSUS tariff schedules the articles considered here were subject, under the provisions of paragraph 304, to eight different rates of duty, depending principally on their unit value; if of alloyed iron or steel, they were also subject to additional duties under the provisions of paragraph 305. The consolidation in the TSUS of the former provisions into two provisions for unalloyed products (items 608.15 and 608.16) and a single provision for alloyed products (item 608.18) did not result in significant rate changes. For example, in 1962 more than 95 percent of the imports of the unalloyed articles valued not over 5 cents per pound were dutiable under paragraph 304 at 8.5 percent ad valorem, the rate now provided for such articles under item 608.15.

For a discussion of the additional duties under items 607.01 to 607.04, see the general statement on the provisions of subpart 2B of schedule 6.

U.S. consumption

Annual U.S. consumption of ingots and of the semifinished steel in the forms considered here approximates domestic production (134 million tons in 1966) since both exports and imports are very small. Domestic producers consume about 97 percent of their output of raw steel in the production of ingots or the semifinished products considered here and then by additional processing convert them into flat-rolled products (viz, plates, sheets, or strip), bars, rods, structural shapes, or more advanced products. During 1958-66, only in 1964 and 1965 did concerns other than the raw steel producers account for more than 3 million tons of domestic consumption of the products covered in this summary.

U.S. imports supply a very small part of the U.S. consumption of ingots and the semifinished products covered here. In 1964-66, imports of these products were equivalent to less than one-half of 1 percent of domestic consumption. A substantial part of the imports in 1964-66 were processed in the United States and then exported (see section on imports).

U.S. producers

Raw steel is produced by about 100 concerns having more than 150 producing establishments. In 1966, 21 of these concerns each produced more than 1 million tons of steel and in the aggregate accounted for about 89 percent of total U.S. production of raw steel in that year;

the three largest concerns accounted for 48 percent. Although raw steel is produced in 31 States, Pennsylvania, Ohio, Indiana, Illinois, and Michigan together accounted for 70 percent of domestic output in 1966. Other important producing States were Maryland, New York, California, Alabama, Kentucky, Colorado, Utah, West Virginia, Minnesota, and Texas.

Many of the steel concerns and, in fact, many of the separate establishments also have facilities for producing each of the semifinished forms covered by this summary--blooms, billets, slabs, and sheet bars. Many other concerns, particularly those specializing in one product or a group of similar products, such as bars and rods, have facilities for producing only the semifinished forms required for their own operation. Most of the small producers consume their entire output of these semifinished products in the fabrication of more advanced steel products; they frequently purchase such semifinished products from others to supplement their own output. The larger producers and certain producers of special alloy grades of steel sell ingots, blooms, billets, and slabs to others.

Many technological advances in steel production in recent years have resulted in both faster and more economical production, as well as product improvement. One of the most significant developments is the use of virtually pure oxygen to speed the chemical reaction that takes place during steelmaking. Although the advantages of oxygen in steelmaking were recognized a century ago, it was not until recently that oxygen became economically available in the large quantities required. The introduction of oxygen into the open-hearth process has resulted in a 20 to 40 percent saving in time necessary per heat. The installation of oxygen plants capable of generating the enormous volume of oxygen required by the process at costs that would make the entire operation feasible was the prime prerequisite for the large-scale adoption during the past decade of the basic-oxygen process, now the second most important steelmaking process in the United States and probably in the world. At the beginning of 1966 the United States accounted for an estimated 30 percent of world capacity for producing basic-oxygen steel, and by the end of that year it was the largest producer of such steel. The widespread adoption of the basic-oxygen process also was facilitated by the development of (a) materials-handling equipment of large capacity and (b) furnace refractories that would withstand the high temperature of the process, as well as the impact shock of the repeated dropping of large tonnages of dense, rough scrap into the furnace.

The present basic-oxygen process was developed in Austria for furnaces of 35-ton capacity per heat. The large-volume U.S. producers of steel delayed adopting the Austrian process until substantially larger furnaces could be used for the large tonnages produced in the United States. The first basic-oxygen furnaces in commercial production in the United States were of about 60-ton capacity per heat. By

the end of 1965, when virtually every major U.S. producer of steel was operating basic-oxygen furnaces, several of them were rated at a capacity of 300 tons per heat and the average size was estimated to be about 175 tons per heat; many furnaces were producing in excess of their rated capacity. The total capacity of the new basic-oxygen furnaces does not represent a net increase in U.S. steelmaking capacity; in a large number of plants, as many as 14 open-hearth furnaces were dismantled to make room for as few as 2 basic-oxygen furnaces. The greatest advantage of the basic-oxygen process over the open-hearth process is the saving in time required per heat, the basic-oxygen process requiring 1 hour or less, and the open-hearth process, 6 to 10 hours.

Another recent and widely adopted innovation in steelmaking has been vacuum degassing, formerly reserved for very special quality steel. The principal function of the various degassing processes currently in use is the withdrawal of gases generated by chemical reactions during the steelmaking process and entrapped in the steel. Non-uniform internal structure caused by gases held in steel after solidification has a degrading effect on its strength and soundness and causes processing and finishing difficulties.

The continuous casting of steel is also a significant recent development; more than a score of continuous-casting machines were in operation at the end of 1965. In this process, molten steel is poured into a vertical open-end mold of the desired shape. While the steel is in the mold, the surface next to the mold solidifies sufficiently to contain the remaining liquid steel in the center; as the steel emerges from the bottom of the mold, it is cooled by water and then may be cut to processing length while still vertical, or it may be passed through a 90-degree arc and cut in the horizontal position. Most of the continuous-casting machines installed to date are used for casting billets; several are in use for casting slabs. Continuous casting has a number of advantages over the conventional methods for producing semifinished forms. These include (a) the elimination of ingot molds, stripping equipment, soaking pits, and primary (bloom, slab, billet) mills; (b) 60 to 75 percent less generation of revert scrap in the production of billets and slabs; (c) faster solidification, resulting in more uniform structure; and (d) smaller initial and operating costs.

Bottom-pressure casting is another method designed to eliminate the ingot and primary-mill stages of producing slabs and billets. In this process, molten steel is forced upward, by air pressure, into a nearly horizontal mold. Following solidification of the steel, the mold is taken off and the steel is ready for further processing.

The introduction of automatically-controlled steelmaking furnaces in recent years has done much to minimize the number of "off quality" heats. The automated controls react faster to temperature and chemical

changes within the furnaces than human operators can, even with the aid of advanced testing devices and instruments.

Although there have been other technical improvements in steelmaking in recent years, those discussed above are probably the most important and of the most general interest. 1/ Advancements in the industry, however, have not been limited to the steelmaking process. Potential improvements in rolling and finishing techniques are constantly being researched. Notable among these is the automated control of rolling mills--primary mills for making blooms, billets, slabs, and sheet bars, as well as finishing mills. Roll position, mill speed, and other variables are automatically adjusted resulting in products of more nearly uniform dimensions and properties.

Several major producers are currently planning or constructing steel plants incorporating all of the above-mentioned advanced techniques.

U.S. production and shipment

Production.--For many years the production of raw steel in the United States has exceeded that in any other country. During 1946-50, annual U.S. production of raw steel averaged about 83 million tons and represented half the estimated world output. The U.S. position in world production of raw steel during those years reflected the war damage to much of the foreign steelmaking capacity. As foreign producers rebuilt, expanded, and modernized their plants, steel production in many foreign countries increased at a faster rate than that in the United States, and the U.S. share of world output declined to 41 percent in 1951-55, to 31 percent in 1956-60, and to 26 percent in 1961-65.

Domestic production of raw steel increased from 85.3 million tons in the recession year of 1958 to 93.4 million tons in 1959 (despite almost complete cessation of production for 116 days because of a strike), and to 99.3 million in 1960. After declining to 98.0 million tons in 1961, annual domestic output rose without interruption to 134.1 million tons in 1966 (table 1). Most of the increase in U.S. output since 1961 has resulted from the use of the new basic-oxygen furnaces. During the period 1961-66, annual steel production in basic-oxygen furnaces increased by 30.0 million tons, or 755 percent; during the same period annual steel production in electric furnaces increased by 6.2 million tons, or 71 percent. Production of steel by the open-hearth process, which declined substantially in 1965 and 1966, was about the same in 1966 as in 1961. Of the total domestic production of raw steel

1/ The rapidly increasing use of high-quality iron ore and its effects on steelmaking are discussed in the first summary of this volume.

in 1966, 63.4 percent was produced by the open-hearth process, 25.3 percent by the basic-oxygen process, and 11.1 percent by the electric process. The U.S. production of steel by the bessemer process has declined by more than 90 percent since World War II and in 1966 accounted for only 0.2 percent of total production.

During the last two decades, between 88 and 92 percent of the total annual quantity of steel produced has consisted of carbon steel (i.e. steel of the type provided for in items 608.15 and 608.16). Since 1960, however, while the annual output of carbon steel has increased in tonnage, its share of the total steel output has declined, owing in part to the rising production of high-strength, low-alloy steels for pipe, plates, and structural shapes. Such steels enable consumers to use less steel to get the same results as those obtained from the use of carbon steel, or better. Stainless steel has consistently accounted for 1.1 to 1.2 percent of annual steel production in recent years. Data from the American Iron and Steel Institute show total annual production of raw steel, by types, in 1958 and 1964-66, as follows (in thousands of short tons):

Year	Carbon steel	Alloy steel		Total
		Stainless	Other	
1958	78,590	896	5,769	85,255
1964	114,442	1,443	11,191	127,076
1965	116,651	1,493	13,318	131,462
1966	118,732	1,651	13,718	134,101

In recent years the production of alloy steel has increased in terms of quantity and in relation to total U.S. steel output. In 1966 the alloy grades of steel accounted for 11.5 percent of the total steel produced; in 1958, they accounted for 7.8 percent. In 1966, alloy steel accounted for 38 percent (5.7 million tons) of the total production of steel in electric furnaces, and for about 9 percent (7.7 million tons) of that produced in open-hearth furnaces. A small but rapidly increasing proportion of the output of basic-oxygen furnaces is of alloy steel. The proportion increased from 2.5 percent in 1964 to 6 percent in 1966, and is expected to increase further, reflecting the substantial progress made in developing techniques for producing alloy steels in basic-oxygen furnaces. Little, if any, alloy steel is made in the United States by the acid bessemer process.

Data are not separately reported for the production of billets as opposed to that of slabs and sheet bars. It is believed that more steel is converted into slabs or sheet bars than into billets.

U.S. shipments.--As indicated previously, the great bulk of the raw steel produced in the United States is further processed by the steel producers. Data published by the American Iron and Steel Institute show producers' shipments of ingots, blooms, billets, slabs, and sheet bars combined in 1958-66, as follows:

Year	1,000 short tons	Year	1,000 short tons
1958	2,137	1963	2,686
1959	2,824	1964	3,541
1960	2,412	1965	4,036
1961	2,161	1966	3,020
1962	2,210		

Owing in part to the large volume of exports in 1964 and 1965, producers' shipments were larger in those 2 years than in other recent years. The following tabulation, compiled from data of the American Iron and Steel Institute, shows domestic producers' shipments of ingots and the semifinished products covered by this summary, by type of steel, in 1966:

Product and type of steel	Quantity	Percent of total
	1,000 short tons	
Ingots:		
Carbon steel	177	5.9
Alloy steel:		
Stainless and heat-resisting steel	5	.1
Other	168	5.6
Total	350	11.6
Blooms, billets, slabs, and sheet bars:		
Carbon steel	2,026	67.1
Alloy steel:		
Stainless and heat-resisting steel	69	2.3
Other	575	19.0
Total	2,670	88.4
Grand total	3,020	100.0

The wholesale price of rerolling- and forging-quality carbon steel billets, as computed by the U.S. Bureau of Labor Statistics, increased by 5.1 and 4.7 percent, respectively, between December 1958 and December 1966. The Bureau has not reported price changes for any other product covered herein.

U.S. exports

In all but 5 years since 1945 the United States has been a net exporter of steel ingots, blooms, billets, slabs, and sheet bars. Annual exports increased from 15,000 tons in 1959 (when an extended labor strike curtailed U.S. output) to 855,000 tons in 1964 (table 2). The 1964 exports accounted for almost a fourth of domestic producers' total shipments. Exports declined in 1965 and 1966, both in terms of quantity and in relation to total shipments. During 1963-66, U.S. exports of the products considered here consisted in large measure of shipments under programs of the Agency for International Development.

Much of the U.S. exports of ingots and semifinished steel consist of grades of steel not commonly produced in the receiving countries. In recent years, exports have consisted principally of billets and slabs of carbon steel. Only about 1 percent of the total volume of exports in 1965, and about 4 percent in 1966, were of alloy grades of steel.

Argentina and Pakistan have been the principal export markets in recent years; Spain, Mexico, Canada, and Chile have also taken significant tonnages (table 2). The steel strike in the United Kingdom during 1964 was undoubtedly responsible for the sizable U.S. exports to that country in that year.

U.S. imports

Annual imports of steel ingots, blooms, billets, slabs, and sheet bars have varied widely during the years since World War II, showing no distinct trend. Imports reached a peak of 345,000 tons in 1964, most of which was imported free under bond for manufacture (principally rolling) and export (see item 864.05 in schedule 8 of the TSUS). Imports declined in 1965 and again in 1966, amounting to 224,000 tons in the latter year (table 3). Frequently imports represent transactions between U.S. concerns and their foreign subsidiaries or affiliates.

U.S. imports in recent years have consisted principally of slabs and billets. Imports of ingots have been significant, but imports of blooms, which are an intermediate form in the hot rolling of billets or slabs, have probably been very small.

In 1964-66, a substantial portion of the imports were entered duty free under bond for manufacture and export (table 4). Such duty-free entries accounted for 62 percent of the imports in 1964, 19 percent in 1965, and 23 percent in 1966. Significant quantities of the imports on which duties were paid were also advanced in condition in the United States and then exported. Section 1313 of title 19 of the

U.S. Code provides for the virtual recovery (drawback) of the duties paid on imported merchandise (or substituted domestic merchandise of the same kind and quality) when it is exported in a changed condition. In 1965, duties were recovered on 166,000 tons of the products included in this summary and used in the production of motor vehicles and parts. In that year duties were also recovered on about 13,000 tons of billets or slabs of stainless steel that were exported in the form of plates, sheets, or other products discussed in this volume. Information is not available on the date of either the importation of the merchandise on which the duty was recovered or the exportation of the finished product. Comparable data on the payment of drawback in other years have not been compiled.

Alloy steel, principally of forging quality, constitutes a substantially larger share of the imports of ingots, blooms, billets, slabs, and sheet bars than it does of either U.S. production or exports of these products. Of the total volume of imports considered here, alloy steel accounted for about 15 percent in 1964, for 27 percent in 1965, and for 39 percent in 1966. Of these alloy steel imports, 47 percent were entered duty free in 1964; 34 percent, in 1965; and 66 percent, in 1966. In those 3 years 109,136 tons of ingots, blooms, billets, slabs, and sheet bars of alloy steel were imported duty free, of which 67,729 tons was for manufacture and export, and 41,407 tons for U.S. Government use. Total annual imports of these products of alloy steel (both dutiable and duty-free) in 1964-66 and their alloy content subject to the additional duties provided in items 607.01 to 607.04 were as follows (in short tons):

	1964	1965	1966
Ingots, blooms, billets, slabs, and sheet bars:			
Alloy steel, total imports----	53,298	75,334	88,179
Dutiable alloy content:			
Chromium (item 607.01)------	2,969	7,546	7,043
Molybdenum (item 607.02)----	65	181	303
Tungsten (item 607.03)------	2	7	4
Vanadium (item 607.04)------	7	10	14

At least half of the total tonnage of the imports of the alloy steel products included here were of stainless steel in each of the years 1964-66 (table 3). In terms of value, imports of alloy steel in these forms increased from about three-eighths of total imports in 1964 to three-fourths in 1966. In the latter year stainless steel accounted for about two-thirds of the total value of imported alloy steel products here considered.

Canada is by far the principal source of U.S. imports of ingots, blooms, billets, slabs, and sheet bars; in recent years substantial tonnages have also come from the United Kingdom, West Germany, and Japan (table 5). Almost all of the temporary imports for manufacture and export, as well as of the substantial tonnages imported for U.S. Government use, have also come from Canada.

Foreign production

During the past two decades the substantial expansion of facilities for producing raw steel has been worldwide. Output potential has been increased in virtually all the traditional steel-producing nations, and new steel industries have been established in many other countries. Steel production has also generally increased, but probably not to the same degree as capacity. World production of raw steel increased by one-third during the years 1960-65--from 382 million tons in 1960 to 508 million tons in 1965. The production of raw steel by principal producing countries in 1960, 1964, and 1965 is shown in table 6. Almost without exception, annual output increased in each of the listed countries, which together accounted for more than 90 percent of total world production in both 1964 and 1965.

In foreign countries, as in the United States, the basic-oxygen steelmaking process has accounted for the bulk of the increased capacity and production in recent years. At the end of 1965, total world capacity for producing steel by this method was estimated at 120 million tons, and capacity for an additional 40 million tons was planned. Other refinements in the steelmaking process (e.g., vacuum degassing and continuous casting) and improvements in rolling-mill and finishing techniques are also being introduced and expanded on a large scale throughout the world. Nevertheless, data assembled and published by the Organization for Economic Cooperation and Development indicate that, despite the improvements in steelmaking abroad, productivity measured in terms of annual steel output per production worker is still substantially higher in the United States than in any other free-world country.

U.S.S.R.--The production potential of the steel industry in the U.S.S.R. is second only to that of the U.S. steel industry. Annual steel output in the U.S.S.R. has expanded steadily since World War II; its production of raw steel amounted to about 100 million tons in 1965 and is expected to be about 140 million by 1970.

European Economic Community.--Steel production in the European Economic Community (EEC) amounted to 94.8 million tons in 1965 and is expected to rise to about 121 million tons in 1975. About 37 percent of the raw steel produced in the EEC in 1965 was made by the Thomas

(or basic bessemer) process; about 31 percent was produced by the open-hearth process; and 19 percent, by the basic-oxygen process. In the future, raw steel production in the EEC by the basic bessemer process is expected to decline, while that by the basic-oxygen process increases.

Japan.--The capability of Japan's steel industry was reduced by three-fourths or more during World War II; annual raw steel output declined from 8.4 million tons in 1943 to substantially less than a million tons in 1946. Japan now ranks third in the world as a steel producer and at the end of 1966 had a rated steel capacity of almost 62 million tons.

In the early 1960's and until 1965, Japan led the world in the production of steel by the basic-oxygen process. In 1965, 54 percent of its total raw steel output of 45.4 million tons was produced by this process; 25 percent, by the open-hearth process; and 21 percent, by the electric process. Additions to Japan's steelmaking facilities, which are likely to be of the basic-oxygen type, are not expected to be nearly as extensive as the additions to facilities of that type in the United States.

The United Kingdom.--The United Kingdom is the fifth largest steel-producing country in the world. Its steel production capacity has been increased by almost 50 percent during the last decade, and in 1965 it produced more than 30 million tons of raw steel. The steel industry of the United Kingdom was nationalized in 1951 but was returned to private ownership in 1953. Early in 1967 most of the British steelmaking facilities were again nationalized.

Table 1.--Raw steel: U.S. production, by type of furnace, 5-year averages 1946-65, annual 1956-66

(In thousands of short tons)

Period	Open-hearth	Basic-oxygen	Electric	Bessemer	Total
5-year average:					
1946-50	74,687	-	4,246	4,057	82,990
1951-55	92,435	61	6,941	3,628	103,065
1956-60	89,683	1,530	8,036	1,934	101,183
1961-65	89,716	11,277	11,016	819	112,828
Annual:					
1956	102,841	506	8,641	3,228	115,216
1957	101,658	612	7,971	2,475	112,715
1958	75,879	1,323	6,656	1,396	85,255
1959	81,669	1,864	8,533	1,380	93,446
1960	86,368	3,346	8,379	1,189	99,282
1961	84,502	3,967	8,664	881	98,014
1962	82,957	5,553	9,013	805	98,328
1963	88,834	8,544	10,920	963	109,261
1964	98,097	15,442	12,678	858	127,076
1965	94,193	22,879	13,804	586	131,462
1966	85,025	33,928	14,870	278	134,101

Source: Compiled from data published by the American Iron and Steel Institute.

Table 2.--Ingots, blooms, billets, slabs, and sheet bars of iron or steel: U.S. exports of domestic merchandise, by principal markets, 1964-66

Market	1964	1965	1966
	Quantity (short tons)		
Argentina	78,536	225,134	137,091
Pakistan	419,137	163,438	75,005
Mexico	2,555	34,181	64,739
Canada	9,356	21,619	25,040
Chile	4	18,669	28,597
Spain	178,045	205,257	5,806
All other	1/ 166,935	4,885	2,201
Total	854,748	673,183	338,479
	Value (1,000 dollars)		
Argentina	5,901	16,385	10,358
Pakistan	31,443	13,628	6,944
Mexico	376	2,677	5,078
Canada	2,083	2,697	2,730
Chile	3	1,337	1,953
Spain	12,242	13,998	369
All other	1/ 13,065	964	857
Total	65,113	51,686	28,289

1/ Includes exports of 73,838 tons, valued at 5,959 thousand dollars, to the United Kingdom; 32,935 tons, valued at 2,338 thousand dollars, to Turkey; and 33,306 tons, valued at 2,288 thousand dollars, to Italy.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Ingots, blooms, billets, slabs, and sheet bars of iron or steel: U.S. imports for consumption, by TSUS item number, 1964-66

Year	Item 608.15	Item 608.16	Item 608.18		Total
			Stainless steel	Other alloy steel	
	Quantity (short tons)				
1964	286,515	4,947	28,994	24,304	344,760
1965	202,362	4,925	44,110	31,224	282,621
1966	130,127	5,546	44,088	44,091	223,852
	Value (1,000 dollars)				
1964	22,223	843	8,249	5,212	36,527
1965	13,107	650	15,176	6,334	35,267
1966	7,940	1,101	17,712	8,400	35,153

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Ingots, blooms, billets, slabs, and sheet bars of iron or steel: U.S. imports for consumption, by tariff treatment, 1964-66

Year	Dutiable	Free		Total
		For manufacture and export	For Government use	
	Quantity (short tons)			
1964	111,775	214,995	17,990	344,760
1965	214,222	54,936	13,463	282,621
1966	148,923	51,048	23,881	223,852
	Value (1,000 dollars)			
1964	12,691	20,771	3,065	36,527
1965	25,266	7,802	2,199	35,267
1966	14,221	16,650	4,282	35,153

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 5.--Ingots, blooms, billets, slabs, and sheet bars of iron or steel: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Canada	331,864	224,545	201,027
United Kingdom	1,519	37,293	20,225
West Germany	2,238	13,363	1,042
Japan	198	3,576	1,038
All other	8,941	3,844	520
Total	344,760	282,621	223,852
	Value (1,000 dollars)		
Canada	35,184	29,664	31,924
United Kingdom	278	3,520	2,667
West Germany	234	1,172	226
Japan	56	553	188
All other	775	358	148
Total	36,527	35,267	35,153

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note.--Almost all the duty-free imports shown in table 4 were from Canada.

Table 6.--Raw steel: Production by principal producing countries, 1960, 1964, and 1965

(In thousands of short tons)

Country	1960	1964	1965
United States	99,282	127,076	131,462
U.S.S.R	71,973	93,738	100,310
European Economic Community:			
West Germany	37,589	41,159	40,588
France	18,907	21,804	21,610
Italy	9,071	10,795	13,978
Belgium	7,923	9,624	10,106
Luxembourg	4,502	5,025	5,054
Netherlands	2,141	2,924	3,468
Japan	24,403	43,871	45,372
United Kingdom	27,222	28,918	30,246
Mainland China	1/	2/ 15,400	2/ 16,500
Canada	5,809	9,131	10,029
Poland	7,585	9,449	10,018
Czechoslovakia	7,460	9,234	9,789
India	3,622	6,649	6,962
Australia	4,137	5,603	6,092
Sweden	3,547	4,894	5,208
East Germany	3,678	4,841	4,883
Spain	2,115	3,472	4,134
South Africa	2,328	3,414	3,743
Austria	3,487	3,520	3,553
Total, listed countries	3/ 340,775	452,286	474,479
All other	34,809	20,239	24,435
World total 4/	381,590	480,780	507,540

1/ Reliable estimate not available.
2/ Estimated.
3/ Excludes mainland China.
4/ Partly estimated.

Source: Compiled from official statistics of the U.S. Department of the Interior.

Commodity	TSUS item
Forgings, not machined, not tooled, and not otherwise processed after forging:	
Other than alloy iron or steel	608.25
Alloy iron or steel	608.27

Note.--For the statutory description of each item, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

Trade in rough forgings of iron or steel is insignificant because such forgings are generally further processed by the producers themselves. U.S. imports, almost all of which in recent years have been for Government use, are believed to be equivalent to less than 1 percent of the large annual production. U.S. exports are also believed to be small.

Description and uses

Forgings of iron or steel are made by hammering or pressing heated ingots, blooms, billets, slabs, or bars to a desired size and shape. The forging processes permit the production of complicated shapes of great strength and ductility that cannot be produced by rolling or casting. Large shapes are generally produced on regulation press-and-hammer forging equipment with dies that are flat or slightly shaped; the forgings so produced are called open-die forgings. Small- and medium-size shapes, however, are usually forged with the use of dies accurately formed to the size and shape of the desired finished product; these forgings are known as closed-die (or drop) forgings. Nearly all open-die forgings require machining (cutting, planing, turning, boring, milling, or grinding) to give them the desired dimensions, whereas closed-die forgings require little or no subsequent machining. Forgings often require heat treating (e.g., annealing and tempering) to improve the properties of the steel.

The forgings classifiable for tariff purposes under items 608.25 and 608.27 are semifinished products of rough appearance that require considerable further shaping. For example, an ingot roughly hammered into the shape of a flattened zig-zag and requiring considerable further shaping to produce a marine crankshaft would be classified under either of these items. On the other hand, drop forgings would

generally be excluded from these items since they are in such an advanced state as to be articles or parts of articles classifiable elsewhere in the TSUS.

Forgings that have been machined or otherwise processed are classifiable for tariff purposes as specific articles provided for by name or as parts of certain end-use products. Examples of steel forgings separately provided for in the TSUS are axles and axle bars (item 690.25), wheels (item 690.30), anchors (652.03), chains (652.12 et seq.), wrenches (648.97), and certain machine tools (674.50 et al.)

Most of the rough forgings included in this summary are machined by the producers thereof, and a substantial portion are also used by them in the manufacture of end products. Steel forgings are used extensively in the production of aircraft, missiles, rockets, artillery, small arms, automotive equipment, railroad equipment, and other machinery and in the mining, construction, and roadbuilding industries. In many of these applications, forgings of alloy steel are required.

In this summary all quantities are given in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Forgings, not machined, not tooled, and not otherwise processed after forging:	
608.25	Other than alloy iron or steel----------	10.5% ad val.
608.27	Alloy iron or steel----------	14.5% ad val. + additional duties. 1/

1/ As provided for in items 607.01 to 607.04 (see appendix A).

The 10.5-percent rate for the forgings in item 608.25, in effect since June 30, 1958, is the same as the rate under paragraph 319(a) of the former tariff schedules and reflects a concession granted by the United States in the General Agreement on Tariffs and Trade (GATT). The 14.5-percent rate for the forgings in item 608.27, also a GATT

rate, is equivalent to the sum of the ad valorem rates formerly provided under paragraphs 305 and 319(a) for such articles of alloy iron or steel. The additional specific duties on the chromium, tungsten, molybdenum, and vanadium content, which were also formerly provided for under paragraph 305, are now provided for under items 607.01 to 607.04. For a discussion of these additional duties, see the general statement on the provisions of subpart 2B of schedule 6.

In 1966, as in earlier recent years, a large portion of the imports reported in the import statistics under items 608.25 and 608.27 were entered duty free for U.S. Government use under the provisions of subpart 3A of schedule 8 of the TSUS.

U.S. consumption and production

Data are not available on the U.S. production or consumption of the rough forgings here considered. A substantial portion of such forgings are further processed by the producers thereof. Because of the high level of production of motor vehicles in recent years and the rising military requirements, apparent consumption of rough forgings is believed to have trended upward since 1958.

Steel forgings are produced in the United States by about 330 forge shops, of which more than 200 are closed-die forge shops. Currently there are about 40 fewer forge shops than there were in 1958. A few of the major forge shops produce their own steel, but in the aggregate the forging producers purchase more than half of their steel requirements from steel mills. A forge shop generally produces forgings for two or more end-use markets. Probably about half of the shops, however, could produce any type of forging, since a particular type or style of forging can be made on more than one kind of equipment. Producers often shift production to supply entirely different markets. At least 36 forge shops are owned by motor-vehicle, railroad, and other companies that produce forgings for their own use. These so-called captive shops probably account for a fifth to a third of total domestic production.

Steel-forging producers are concentrated principally in the East North Central States (Ohio, Michigan, Illinois, Wisconsin, and Indiana) and in Pennsylvania. At the present time, U.S. producers of steel forgings are consuming steel at the rate of slightly more than 2 million tons a year (excluding the scrap generated in their operations). Their current capacity of more than 7 million tons a year reflects the high demand for forgings during wartime. From the late 1950's through the early 1960's, a period when military procurements were at a low level, requirements for forgings declined partly because of the transition from manned aircraft, ships, and tanks to missiles and rockets. Although there are important applications of

steel forgings in missiles and rockets, the tonnage so used is smaller than that required for manned aircraft. The demand for forgings for use in motor vehicles, however, has been rising since 1961, and more recently the demand for forgings by the military has also increased considerably owing to the Viet-Nam conflict.

Largely because of the low rates of equipment utilization in recent years, producers of steel forgings have made few investments in new equipment. More than three-fifths of their equipment (consisting principally of hammers, presses, and upsetters) is now more than 10 years old; about half of it is more than 20 years old.

In the absence of production statistics on the rough forgings considered in this summary, the data published by the U.S. Bureau of the Census on annual shipments of iron or steel forgings by U.S. establishments primarily engaged in manufacturing such forgings with or without the use of dies (industry 3391) may be considered indicative of recent trends in forging activity. Establishments which produce forgings and also engage in the fabricating operations (such as machining and assembling) required in the production of end products are not included in industry 3391 but in the industry number for the end product. Shipments of iron and steel forgings by industry 3391, which were valued at $671 million in 1958 and at $834 million in 1963, consisted principally of forgings of carbon (unalloyed) steel during 1958-65, as indicated in the following tabulation (in thousands of short tons):

	Carbon steel	Alloy steel	Total
1958	621	458	1,079
1959	808	566	1,374
1960	753	515	1,268
1961	684	499	1,183
1962	880	612	1,492
1963	942	611	1,553
1964	1,071	663	1,734
1965	1,307	738	2,045

About three-fourths of the total shipments shown above are closed-die forgings, and the remainder, open-die hammer-and-press forgings. Although only one-third of the closed-die forgings are made of alloy steel, almost three-fifths of the open-die hammer-and-press forgings are of alloy steel.

U.S. exports

In the official U.S. export statistics, roughly forged pieces of iron or steel of the type classifiable under items 608.25 and 608.27 are not separately reported; they are included in the export data for ingots, blooms, billets, slabs, and sheet bars (see preceding summary of this volume). Exports of such forgings are believed to be small.

The rough steel forgings for which separate export data are available (export statistical classes 679.3020 and 679.3030) include crank pins, crankshafts, drop forgings, gun forgings, and many other articles not covered by the TSUS items in this summary. Exports of these rough steel forgings in 1964-66 are shown in table 1. Forgings of alloy steel made up about 30 percent of the quantities exported in those years.

U.S. imports

Annual U.S. imports of rough forgings of iron or steel averaged less than 1,000 tons during 1958-61; they amounted to 6,059 tons in 1962, increased to 7,634 tons in 1963, declined to 1,408 tons in 1965, and amounted to 4,447 tons in 1966 (table 2). In 1958-66, annual imports constituted considerably less than 1 percent of annual consumption. More than 85 percent of the forgings imported during 1962-66 entered free of duty for U.S. Government use. In the TSUS, as stated in the discussion of U.S. tariff treatment, imports for the use of agencies of the Government are entered duty free under provisions of subpart 3A of schedule 8.

In recent years, imports have consisted mostly of forgings made of alloy steel; in 1966 about 90 percent of the quantity was of alloy steel. The reported values of the imports 1/ averaged $247 per ton in 1958, $514 in 1965, and $472 in 1966. Canada has been the principal supplier in recent years.

1/ Generally the market values in the foreign country; therefore, they exclude U.S. import duties, freight, and transportation insurance.

Table 1.--Steel forgings in the rough state: U.S. exports of domestic merchandise, by principal markets, 1964-66

Market	1964	1965	1966
	Quantity (short tons)		
Canada	8,177	5,321	6,837
United Kingdom	178	338	626
France	126	124	232
India	1,411	1,991	512
Mexico	425	834	626
Italy	1,386	24	64
Brazil	262	59	283
West Germany	32	37	31
Japan	14	54	134
Republic of South Africa	14	350	223
Venezuela	1,465	58	72
All other	1/ 13,502	1,358	797
Total	26,992	10,548	10,437
	Value (1,000 dollars)		
Canada	6,880	7,326	12,853
United Kingdom	145	474	902
France	182	479	432
India	849	1,314	419
Mexico	217	469	342
Italy	471	93	211
Brazil	145	47	153
West Germany	36	131	104
Japan	36	223	99
Republic of South Africa	11	166	96
Venezuela	364	84	36
All other	1/ 3,711	797	552
Total	13,047	11,603	16,199

1/ Includes exports to Peru of 8,306 tons, valued at 1,542 thousand dollars.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note.--These data, which were reported under export statistical classes 679.3020 and 679.3030, include crank pins, crankshafts, drop forgings, gun forgings, and many other articles not covered by the TSUS items in this summary. Exports of the roughly forged pieces of the type classifiable under these TSUS items are not separately report but are included in the export data for ingots, blooms, billets, slabs, and sheet bars (see preceding summary in this volume).

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Table 2.--Forgings of iron or steel, not machined, not tooled, and not otherwise processed after forging: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Canada	2,592	1,121	3,774
Sweden	264	56	217
West Germany	456	11	123
Japan	53	187	233
All other	191	33	100
Total	3,556	1,408	4,447
	Value (1,000 dollars)		
Canada	1,572	634	1,885
Sweden	79	18	68
West Germany	83	4	61
Japan	20	49	52
All other	44	19	33
Total	1,798	724	2,099

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Deformed reinforcing bars of steel--	608.40, -.41, -.42

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

The United States is the free world's leading consumer of deformed reinforcing bars. In the 6 years 1961-66, imports, which were many times larger than exports, supplied from 12 to 20 percent of the total quantity consumed in the United States.

Description and uses

Reinforcing bars (generally called re-bars in this summary) are long, solid bars approximately round in cross section that are practically indispensable in the construction of modern concrete structures, such as highways, runways, driveways, buildings, and patios. Re-bars embedded in the concrete increase the resistance of structures to tension, compression, and shear forces.

Almost all re-bars in use today have deformations around the circumference to prevent longitudinal movement when they are embedded in concrete. Items 608.40 to 608.42 provide only for deformed concrete reinforcing bars, which are defined in headnote 3(d) to part 2B of schedule 6 of the TSUS as "hot rolled steel bars, of solid cross section, having deformations of various patterns on their surfaces." Smooth or plain re-bars, which are used in some structures, are classifiable for tariff purposes as "other" bars of steel under items 608.45 to 608.52 (see following summary in this volume).

Re-bars are generally hot-rolled from carbon steel billets rather than from alloy steel; some of them are rolled from old railroad rails or from similar reclaimed material. The billets or the reclaimed material is heated to a uniform temperature suitable for rolling and then passed through a series of reducing rolls until the desired diameter is reached. The deformations are imparted in the final stand of rolls and vary in depth with the diameter of the bar.

Concrete reinforcing bars are made in three grades--structural, intermediate, and hard. The three grades differ only in their mechanical properties, principally tensile strength, and may be produced

from low carbon steel made by virtually any steelmaking process. The predominant quality requirement of re-bars is that they satisfy the strength criteria of Federal and State construction codes.

Re-bars are generally shipped in standard lengths of 20, 40, 60, 80, or 100 feet, to be recut for fabrication (shaping) as required by the detailed design of a particular construction project. The standard sizes of re-bars, which correspond to standard bar sizes 2 through 11, range from 1/4 inch to 1-1/4 inches in 1/8-inch diameter intervals. Re-bars are also frequently made in bar sizes 14S and 18S, which have diameters of approximately 1-3/4 inches and 2-1/4 inches, respectively. Some re-bars are cut by the mill to design length.

In this summary, all quantities are given in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Deformed reinforcing bars of steel:	
	Of other than alloy steel and valued--	
608.40	Not over 5 cents per pound----------	8.5% ad val.
608.41	Over 5 cents per pound----------	12.5% ad val.
608.42	Of alloy steel----------	16.5% ad val. + additional duties. 1/

1/ As provided under items 607.01 to 607.04 (see appendix A).

These rates, derived from rates that had been in effect at least since June 30, 1958, reflect concessions granted by the United States in the General Agreement on Tariffs and Trade. In the pre-TSUS tariff schedules the articles considered here were subject, under the provisions of paragraph 304, to eight different rates of duty, depending on their unit value; if of alloyed iron or steel, they were also subject to additional duties under the provisions of paragraph 305. The consolidation in the TSUS of the former provisions into two provisions for unalloyed products (items 608.40 and 608.41) and a single provision for alloyed products (item 608.42) did not result in significant rate changes. In fact, 99.7 percent of the 1962 imports of unalloyed re-bars valued not over 5 cents per pound were dutiable under paragraph 304 at 8.5 percent ad valorem, the rate now provided under item 608.40.

Moreover, 97.6 percent of the 1962 imports of re-bars valued over 5 cents per pound were dutiable at 12.5 percent, the rate now provided under item 608.41. Re-bars of alloy steel subject to the additional duties under items 607.01 to 607.04 are seldom imported. These additional duties are discussed in the general statement on the provisions of subpart 2B of schedule 6.

On April 14, 1964, the Secretary of the Treasury issued a "finding of dumping" on steel reinforcing bars from Canada (T.D. 56150, 29 F.R. 5341), and since then special dumping duties, in addition to the regular duties, have been payable on such imports from a particular exporter in Canada. Imports of re-bars from that source, which was not a major supplier to the U.S. market, virtually ceased following the antidumping action. As required by the Antidumping Act, the Secretary's "finding of dumping" had been preceded by determination of the Tariff Commission that a domestic industry was likely to be injured. 1/

U.S. consumption

Apparent U.S. consumption of re-bars, which depends in large measure on the activity in concrete construction projects, amounted to about 2.8 million tons in 1958, about 3.0 million tons in 1962, and thereafter trended upward to almost 4.4 million tons in 1966. The data on apparent consumption shown in table 1 for 1959, and to a lesser extent those for 1965, may be somewhat overstated; hedge buying from foreign sources during periods of uncertain labor conditions in the United States, which is reflected in the import figures shown, may have accounted for a sizable part of foreign re-bars purchased but not actually consumed. The ratio of reported imports to apparent consumption increased abruptly from 16 percent in 1958 to about 27 percent in 1959, the year of the extended steel strike in the United States; declined to about 11 percent of U.S. consumption by 1964; and was equivalent to 13 and 15 percent in 1965 and 1966, respectively.

Domestic producers

About 45 concerns produce reinforcing bars in plants situated in 22 States, principally in Pennsylvania, California, and Illinois. Much of the domestic re-bar is produced by the fully integrated iron and steel producers; however, a substantial part of it is made by semi-integrated steel producers or by a relatively few nonintegrated rolling

1/ U.S. Tariff Commission, Steel Reinforcing Bars From Canada: Determination of Likelihood of Injury, TC Publication 122, 1964 (processed).

mills that produce re-bar from purchased billets or from reclaimed material and generally have a very limited product line.

Annual domestic capacity for the production of re-bars on January 1, 1960, was reported at about 2.9 million tons; no later figure is available. Since 1960 at least two additional mills capable of rolling re-bars have been placed in operation in depressed areas with assistance from the Area Redevelopment Administration. 1/ The mill equipment on which re-bars are rolled can also be used to roll other bars, bar-size shapes, and wire rods. Thus, the annual production of re-bars can and does vary significantly, depending in part on the consumer demand for these other products.

The various domestic producers differ in the type of re-bars produced and in the services offered. As indicated previously, most re-bars must be fabricated to specific design lengths and shapes before they can be used in construction. All domestic producers offer re-bars in the standard lengths; some will cut re-bars to design lengths requested by the purchaser; and a third group will completely fabricate re-bars for specific projects. A number of U.S. concerns fabricate, or fabricate and place, re-bars purchased from producing firms, either domestic or foreign. The number of fabricators is understood to be declining, principally because of increased competition from producers expanding into the fabricating field in an effort to maintain or increase their production.

The great bulk of the re-bars produced domestically are sold to three types of customers--warehouses, fabricators, and general contractors. Warehouses generally buy rather small quantities of short standard lengths for resale primarily to small consumers for use in the construction of patios, swimming pools, driveways, and the like. Fabricators purchase re-bars in standard lengths in sizes and quantities that will permit them to fulfill contract obligations. Domestic producers that have facilities for fabricating re-bars have a third potential customer--the general contractor, who purchases re-bars in the forms required for a particular concrete structure.

U.S. production and shipments

Domestic production of re-bars, which amounted to about 2.4 million tons in 1958, declined somewhat in the strike year of 1959 and increased in each of the next 2 years, amounting to 2.6 million tons

1/ The Area Redevelopment Administration, established on May 8, 1961, was terminated on Aug. 31, 1965; its functions were transferred to the Economic Development Administration in the U.S. Department of Commerce, effective Sept. 1, 1965.

in 1961. After declining somewhat in 1962, it increased each year in the 1963-65 period. Domestic output was about 3.8 million tons in 1965, but declined slightly in 1966.

The increase in re-bar production since 1962 has not been shared equally by all States, partly because of the different levels of activity in building and highway construction in the various sectors of the country. While production increased from 1962 to 1966 by 130 percent in Pennsylvania, 140 percent in Texas and Oklahoma, and 175 percent in Alabama and Mississippi, it declined almost steadily in Massachusetts and New York during that period. About 47 percent of domestic output in 1966 was produced in Pennsylvania, California, and Illinois.

Producers' shipments of re-bars, which are usually somewhat less than production principally because of loss to home scrap (see summary on iron or steel scrap, in this volume) and producers' own consumption, increased without interruption from about 2.0 million tons in 1958 to 3.2 million tons in 1964 (table 1). Shipments declined somewhat in 1965 but increased again in 1966, when they amounted to about 3.3 million tons. Of total shipments during each of the years 1962-66, about 60 percent were shipped to the construction industry and producers of contractors' products, and about 18 to 20 percent, to warehouses and distributors.

U.S. exports

U.S. exports of re-bars constituted less than 1 percent of producers' shipments in each of the years 1959-62 and 1966 and were between 1 and 2 percent during 1958 and 1963-65. Exports, which were about 25,000 tons in 1958, declined by almost 50 percent in 1959, but then increased in each year through 1964, when they amounted to almost 61,000 tons (table 1). Owing to reduced exports under the international assistance programs carried on by the Agency for International Development and the demand for re-bars in the United States in anticipation of a strike, exports declined by 43 percent from 1964 to 1965 and by 30 percent from 1965 to 1966. Exports were slightly smaller in 1966 than in 1958.

The foreign markets for U.S. exports of re-bars are widespread and mostly small; they change from year to year, reflecting in part the extent of participation of U.S. firms in major overseas construction projects. The five leading foreign outlets in 1965 (listed in descending order) were Tunisia, South Viet-Nam, the Bahamas, the Philippine Republic, and Liberia. In 1966, the Philippine Republic was displaced by Jamaica, which ranked third, ahead of the Bahamas and Liberia (table 2).

U.S. imports

Stimulated by a steel strike in the United States, imports of re-bars reached the unusually high level of 852,000 tons in 1959 and were equivalent to about 27 percent of domestic consumption. With this exception, annual imports generally increased moderately between 1958 and 1962; in the latter year they amounted to about 607,000 tons and were equivalent to 20 percent of apparent U.S. consumption. Imports declined in 1963 and again in 1964, the decline coinciding with the domestic industry's price reductions by virtual abandonment of its published base prices for re-bars in an effort to arrest the upward trend of imports. The threat of a labor strike, coupled with the continued high level of demand, caused imports to increase significantly during 1965, to about 568,000 tons. Imports continued to increase in 1966 and in that year amounted to 673,000 tons.

U.S. imports of re-bars have consisted almost entirely of those valued not over 5 cents per pound (table 3). Only in 1960 did re-bars valued over 5 cents per pound account for as much as 5 percent of the total volume of imports. The reported value 1/ of imports of re-bars valued not over 5 cents per pound from all sources in 1966 averaged 3.7 cents per pound (or about $74 per short ton). The average reported value of imports in that year ranged from about $69 per ton for imports from Australia to about $93 per ton for those from Canada. The cost of ocean freight and insurance to transport this relatively low-priced material to the United States is estimated to be equivalent to as much as 22 percent of the reported value.

Belgium and Luxembourg have for many years been the principal source of U.S. imports of re-bars and in a number of recent years have accounted for about half of the total imports (table 4). Japan, France, West Germany, and Sweden have also been consistent suppliers. In 1964, Poland, not previously a supplier of re-bars to the U.S. market, ranked fourth in tonnage furnished. The imports from Poland may have resulted in part from Presidential action late in 1960 that granted products of Poland entry into the United States at trade-agreement tariff rates rather than at the higher rates generally applicable to products of Communist-dominated countries (T.D. 55268).

Imported re-bars are generally comparable to those produced in the United States and, like U.S. production, are (with infrequent exception) comprised entirely of bars of other than alloy steel. Re-bars imported from overseas sources, however, are not always as acceptable to fabricators because of rusting as those which can be delivered by rail or truck. Although a normal accumulation of rust does not significantly impair the usefulness of re-bars, excessive rust could be detrimental and probably

1/ Generally the market value in the foreign country; therefore it excludes U.S. import duties, freight, and transportation insurance.

restricts imports, particularly of re-bars in the long lengths preferred by fabricators. Such re-bars are precluded from hold stowage, which would limit rusting. In fabricating imported or domestic re-bars supplied in short lengths, the additional handling and large amounts of scrap generated add substantially to the fabricating costs.

Imported re-bars, like the domestic products, enter the U.S. market through re-bar fabricators, producers of other contractors' products, and steel warehouses. It is believed that warehouses and distributors take a larger share of the imports than of the domestic output.

Table 1.--Steel reinforcing bars: U.S. shipments, exports of domestic merchandise, imports for consumption, and apparent consumption, 1958-66

Year	Shipments	Exports	Imports	Apparent consumption 1/	Ratio of imports to consumption
	1,000 short tons	1,000 short tons	1,000 short tons	1,000 short tons	Percent
1958	2,035	25	474	2,849	16
1959	2,173	14	852	3,152	27
1960	2,214	15	516	2,859	18
1961	2,442	16	583	3,211	18
1962	2,389	22	607	2,966	20
1963	2,683	46	545	3,348	16
1964	3,229	61	412	3,779	11
1965	3,150	35	568	4,305	13
1966	3,276	24	673	4,362	15

1/ Consists of production, plus imports, less exports and thus includes consumption by producers and scrap loss during fabrication by producers.

Source: Shipments, from American Iron and Steel Institute; exports and imports, compiled from official statistics of the U.S. Department of Commerce.

Note.--Import data for 1964-66 relate only to deformed reinforcing bars; the other data shown relate almost entirely to such bars but include smooth or plain reinforcing bars, which are covered in the summary on items 608.45 to 608.52.

Table 2.--Steel reinforcing bars: U.S. exports of domestic merchandise, by principal markets, 1964-66 1/

Market	1964	1965	1966
	Quantity (short tons)		
Tunisia	6,336	9,354	5,737
South Viet-Nam 2/	5,128	5,088	4,143
Jamaica	111	603	2,408
Bahamas	2,494	2,383	1,945
Chile	-	-	1,487
Liberia	1,135	2,202	1,599
Canada	14,912	1,658	1,015
Philippine Republic	1,167	2,261	117
Greece	6,435	180	-
All other	3/ 22,862	10,826	5,768
Total	60,580	34,555	24,219
	Value (1,000 dollars)		
Tunisia	1,108	1,190	827
South Viet-Nam 2/	634	520	460
Jamaica	15	74	354
Bahamas	327	328	268
Chile	-	-	219
Liberia	186	351	203
Canada	1,717	192	197
Philippine Republic	140	267	16
Greece	629	21	-
All other	3/ 3,073	1,409	850
Total	7,829	4,352	3,394

1/ Data relate almost entirely to deformed reinforcing bars but include smooth or plain reinforcing bars (see following summary). The exports for 1965 and 1966 shown here were designated as concrete reinforcing bars of steel.

2/ In the U.S. statistics, trade with South Viet-Nam was separately reported beginning in 1966.

3/ Includes 3,465 tons, valued at 311 thousand dollars, exported to Venezuela; 2,345 tons, valued at 626 thousand dollars, to the Republic of Korea; and 1,501 tons, valued at 133 thousand dollars, to the Congo (Leopoldville, renamed Kinshasa on July 1, 1966).

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 3.--Deformed reinforcing bars of steel: U.S. imports for consumption, by tariff classification (identified by TSUS item numbers), 1958-66

Year	TSUS item 608.40	TSUS item 608.41	TSUS item 608.42 1/	Total
	Quantity (short tons)			
1958	469,694	4,011	-	473,705
1959	839,603	12,347	-	851,950
1960	484,057	31,466	-	515,523
1961	580,896	1,909	-	582,805
1962	606,688	336	-	607,024
1963	544,718	465	20	545,203
1964	410,852	1,055	90	411,997
1965	566,723	292	530	567,545
1966	672,168	1,254	3	673,425
	Value (1,000 dollars)			
1958	34,580	435	-	35,015
1959	67,332	1,365	-	68,697
1960	43,987	3,367	-	47,354
1961	48,246	222	-	48,468
1962	44,208	77	-	44,285
1963	39,145	105	4	39,254
1964	31,952	174	7	32,133
1965	43,893	42	51	43,986
1966	49,291	195	2	49,488

1/ Inasmuch as most of the small imports shown here are known to have been improperly classified for statistical purposes, it is likely that imports entered under this item were nil.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note.--Before Aug. 31, 1963, the effective date of the TSUS, imports may have included small amounts of smooth or plain reinforcing bars, which are now classified under items 608.45 to 608.52.

Table 4.--Deformed reinforcing bars of steel: U.S. imports for consumption, by principal sources, 1958, 1959, and 1964-66

Country	1958	1959	1964	1965	1966
	Quantity (short tons)				
Belgium and Luxembourg	303,132	391,802	211,244	276,423	330,201
Japan	74,235	133,925	87,323	72,729	81,113
France	35,001	179,249	35,116	66,088	79,446
Poland	-	-	34,157	35,278	48,928
West Germany	25,020	91,942	14,126	19,149	46,758
Italy	-	544	2,786	86,211	23,665
Republic of South Africa	-	-	3,166	-	18,146
Sweden	21,609	17,663	19,008	5,280	4,189
All other	14,708	36,825	5,071	6,387	1/ 40,979
Total	473,705	851,950	411,997	567,545	673,425
	Value (1,000 dollars)				
Belgium and Luxembourg	22,023	31,382	16,646	21,184	24,211
Japan	5,892	11,126	6,837	6,034	6,117
France	2,553	14,162	2,649	4,904	5,739
Poland	-	-	2,562	2,710	3,600
West Germany	1,799	7,387	1,079	1,398	3,291
Italy	-	49	233	6,818	1,759
Republic of South Africa	-	-	229	-	1,276
Sweden	1,606	1,390	1,486	426	325
All other	1,142	3,201	412	512	1/ 3,170
Total	35,015	68,697	32,133	43,986	49,488

1/ Includes imports of 16,340 tons, valued at 1,127 thousand dollars, from Australia; 11,567 tons, valued at 1,105 thousand dollars, from Canada; and 12,345 tons, valued at 892 thousand dollars, from Norway.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Note.--Before Aug. 31, 1963, the effective date of the TSUS, imports may have included small amounts of smooth or plain reinforcing bars, which are now classified under items 608.45 to 608.52.

Commodity	TSUS item
Wrought iron bars	608.30, -.32
Solid steel bars (except deformed reinforcing bars)	608.45, -.46, -.48, -.50, -.52
Hollow drill steel	608.60, -.61, -.62

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

Annual U.S. consumption of the products included here, consisting almost entirely of solid steel bars, averaged 10.3 million tons in 1964-66. Annual imports, which rose nearly sevenfold from 1958 to 1966, were equivalent to about 6 percent of apparent domestic consumption in 1966. Exports are much smaller than imports.

Description and uses

For tariff purposes, bars are defined as products of solid section not conforming completely to the specifications in the TSUS for "blooms, billets, slabs, sheet bars, wire rods, plates, sheets, strip, wire, rails, joint bars, or tie plates, and which have cross sections in the shape of circles, segments of circles, ovals, triangles, rectangles, hexagons, or octagons"; see headnote 3 to part 2B of schedule 6, in appendix A. The term "bars"--as used in the tariff schedules--does not include bar-size shapes, which are covered in the summary on angles, shapes, and sections, or hollow bars, which are covered in the summary on pipes and tubes.

In subdivision (e) of headnote 3 mentioned above, hollow drill steel is defined as "a hollow steel product in any cross section suitable for use in making mining drills or mining drill rods, with the largest internal cross-sectional dimension not greater than one-third of the largest external cross-sectional dimension." Hollow drill steel is used in mining and for other drilling operations, principally in construction. Such steel has a longitudinal hole through which water or air is forced to remove chips and dust and to cool the drill bit. Hollow drill steel is high-quality, high-carbon or alloy steel made to withstand the severe service conditions under which it is used.

By far the most important types of iron or steel bars, in terms of tonnage, are the steel bars provided for in items 608.45 to 608.52.

Deformed reinforcing bars of steel, which are significant in terms of tonnage, are separately provided for in the TSUS (items 608.40 to 608.42) and are covered in the preceding summary of this volume. By the mid 1930's, steel bars had virtually replaced wrought-iron bars (items 608.30 and 608.32) in nearly all applications, but some high-quality wrought-iron bars are currently being used for such purposes as the manufacture of certain types of rivets, stay bolts, and ornamental iron work. Wrought iron, unlike steel, contains, by weight, from 1 to 3 percent or more of slag and is usually very low in carbon. It is produced by adding molten bessemer steel to molten slag. The slag, which is uniformly distributed by rolling, imparts a fibrous structure to the bar; see headnote 3(f) to part 2B of schedule 6.

Bars are made (almost always rolled) from virtually any grade of steel, however produced, ranging from the low-priced, low-carbon steels to the high-priced, and often custom-made, high-carbon or alloy steels, including tool steels. Steel bars are generally hot-rolled from billets; they are also made from old rails, axles, and other such products that have outlived their original usefulness. The billets or reclaimed materials are first heated in a furnace to a uniform rolling temperature and then passed through a series of rolls that form the steel into the desired shapes and sizes. After being rolled, the bars are generally cut to standard straight lengths; however, depending on their size and cross-sectional configuration, they may be shipped in coiled form.

In general, there are two grades of hot-rolled carbon (unalloyed) steel bars--merchant quality and special quality. Merchant bars are normally made to conform approximately to certain chemical compositions, such as a maximum carbon content of about 0.5 percent. They are also produced to meet, within specified limits, the standards for certain mechanical properties, in which event the chemical composition is not of special significance. Merchant bars may not be suitable for applications involving forging, severe cold forming, heat treating, or other processes requiring uniformity of structure, internal soundness, or surface perfection, because of possible internal segregation of chemical elements, internal porosity, surface seams, or other irregularities. In the production of special bars, quality control is exercised throughout the operation to meet exactly the chemical or physical specifications. Special bars are used when the end product, or the method of fabricating the end product, requires quality characteristics not guaranteed or available in merchant bars.

Although most steel bars are hot-rolled only, substantial quantities are also cold-finished. Cold finishing includes such processes as cold drawing, cold rolling, turning, grinding, and polishing; these processes may be used singly or in combination with each other, depending upon the characteristics required of the end product. Cold-finished bars are made from hot-rolled bars that have been pickled,

shot-blasted, or otherwise processed to remove scale. Cold drawing and cold rolling impart additional strength, hardness, and machinability to the steel and improve surface finish. Cold rolling is generally reserved for flat bars of a size or configuration not suitable for drawing. Turning, grinding, and polishing have little effect on the mechanical properties of steel bars but are used to obtain a required dimension where a high degree of size accuracy and a superior surface finish are necessary. Cold-finished bars, particularly those that have been turned, ground, or polished, are very susceptible to rust and other surface deterioration. They are normally coated with a light film of oil or other temporary rust preventive material. Hot-rolled bars are frequently galvanized to protect them against corrosive elements; however, cold-finished products are seldom, if ever, so treated.

Steel bars are adaptable to a wide variety of applications. They are used in the production of many of the components of motor vehicles, machinery, appliances, and other equipment and for the production of grills, railings, furniture, tools, dies, and other products. The steel bars covered in this summary are also sometimes used to reinforce concrete in the same manner as deformed reinforcing bars (items 608.40 to 608.42).

In this summary, all quantities are expressed in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Bars of wrought iron:	
608.30	Other than alloy iron	0.5¢ per lb.
608.32	Alloy iron	0.5¢ per lb. + 4% ad val. 1/
	Bars of steel (other than deformed reinforcing bars):	
	Other than alloy steel:	
	Not cold formed:	
	Not coated or plated with metal, valued per pound--	
608.45	Not over 5 cents	7% ad val.
608.46	Over 5 cents	10.5% ad val.
608.48	Coated or plated with metal	0.1¢ per lb. + 10.5% ad val.
608.50	Cold formed	0.0625¢ per lb. + 10.5% ad val.
608.52	Alloy steel	14.5% ad val. 1/
	Hollow drill steel:	
	Other than alloy steel, valued per pound--	
608.60	Not over 8 cents	0.375¢ per lb. + 10% ad val.
608.61	Over 8 cents	10.7% ad val.
608.62	Alloy steel	14.7% ad val. 1/

1/ Plus additional duties as provided under items 607.01 to 607.04 (see appendix A).

These rates reflect concessions granted by the United States in the General Agreement on Tariffs and Trade. In the pre-TSUS tariff schedules, the articles considered here were subject, principally under the provisions of paragraph 303 or paragraph 304, to many different rates of duty, depending on their unit values; if of alloyed iron or steel, they were subject to additional duties under the provisions of paragraph 305. Moreover, iron and steel bars were also subject to duties under paragraph 309 of the pre-TSUS schedules if they were galvanized or coated with zinc, spelter, or other metals and to other additional duties under paragraph 315 if cold-formed or polished. The current rates for all wrought-iron bars (items 608.30 and 608.32) are the same as the rates applicable since April 30, 1950, to such bars valued over 5 cents per pound. This consolidation of the former provisions into the TSUS did not result in any significant rate changes because for several years immediately preceding the adoption

of the TSUS the tariff provisions for the lower value brackets of wrought-iron bars had been obsolete. Similarly, the consolidation of the numerous former provisions for "other" iron and steel bars and those for hollow drill steel into two provisions each for unalloyed products (items 608.45 and 608.46 for "other" bars and items 608.60 and 608.61 for hollow drill steel), two provisions for alloyed products (items 608.52 and 608.62), one provision for bars coated or plated with metal (item 608.48), and one for cold-formed bars (item 608.50) did not result in significant rate changes. The current rate for item 608.45, for example, is the same as the rate that became effective on July 1, 1963, for the bars that had accounted for more than 97 percent of imports of steel bars valued not over 5 cents per pound during 1958-62; and the current rate for item 608.46 is the same as the rate that became effective June 30, 1958, for bars valued over 5 but not over 8 cents per pound and those valued over 16 cents per pound.

The ad valorem equivalents of the specific and compound rates of duty shown on the preceding page, based on imports in 1966, were as follows:

TSUS item	Percent
608.30	3.5
608.32	4.3
608.48	11.9
608.50	11.4
608.60	15.1

About 72 percent of the 1966 imports considered here were dutiable at 7 percent ad valorem under item 608.45, and 10 percent were entered under the item numbers for alloy iron or steel; for a discussion of the additional duties imposed on imports of alloy iron or steel under items 607.01 to 607.04, see the general statement on the provisions of subpart 2B of schedule 6.

On September 17, 1964, the Secretary of the Treasury issued a "finding of dumping" on imports from Canada of carbon steel bars (items 608.45 to 608.50) and of bars-shapes under 3 inches and structural shapes 3 inches and over, products included in the summary on items 609.80 et seq. (T.D. 56264, 29 F.R. 13319). Since then special dumping duties, in addition to the regular duties, have been payable on such imports from a particular exporter in Canada. As required by the Antidumping Act, the Secretary's "finding of dumping"

had been preceded by a determination of the Tariff Commission that a domestic industry was being injured. 1/

U.S. consumption

During the recession year of 1958, apparent U.S. consumption of iron and steel bars amounted to 6.1 million tons, a smaller quantity than in any other year since the 1930's. Consumption has trended upward since 1958; it amounted to 10.5 million tons in 1965 and to 10.4 million in 1966 (table 1). Alloy steel accounts for slightly more than one-quarter of the total U.S. consumption of steel bars, or a larger proportion than it does of the U.S. consumption of most steel products, in part because of the large quantities of alloy steel bars used in making automotive components and tools.

Apparent consumption, by type of product, in 1966 was as follows:

	1,000 short tons	Percent of total
Bars (except re-bar):		
Iron and carbon steel	7,713	74
Alloy steel:		
Stainless	73	1
Other	2,587	25
Hollow drill steel	5	1/
Total	10,378	100

1/ Less than 0.5 percent.

The share of total U.S. consumption of iron and steel bars supplied by imports has increased in recent years from 1.3 percent in 1958 to 3.8 percent in 1964 and to 5.7 percent in 1966. In 1966, the ratio of imports to consumption was about 6.9 percent for carbon steel bars, 11.0 percent for stainless steel bars, and 1.9 percent for alloy steel bars other than stainless. Almost all of the hollow drill steel consumed in the United States is believed to be imported.

U.S. producers

There are about 60 concerns in the United States, with facilities to produce an aggregate of about 14 million tons annually of

1/ U.S. Tariff Commission, Carbon Steel Bars and Shapes From Canada: Determination of Injury, TC Publication 135, 1964 (processed).

hot-rolled iron and steel bars. These concerns operate about 90 establishments in 23 States, of which Pennsylvania, Ohio, Indiana, Illinois, and New York are the leading producers. About two dozen of the concerns producing hot-rolled bars have facilities for cold-finishing such products; and in addition, about 20 concerns that do not have hot-rolling capacity engage in cold-finishing operations.

About a dozen fully integrated steel producers account for about 80 percent of the annual output of bars. Many of the other producers of bars make only merchant-quality bars, and some specialize in bars of special quality or of certain grades, such as tool steel. Very few producers make bars in all shapes, sizes, and grades of steel.

Several domestic producers consume most or all of their production of bars in the manufacture of components of the products for which they are more widely known (viz, automobiles, farm implements, and bearings).

Although shipments of bars represent about 10 percent of the total volume of all products shipped by steel producers as a whole, they constitute well over half of the volume of shipments by many of the smaller, more specialized, semi-integrated or non-integrated concerns. By changing the rolls and certain accessory equipment of bar mills, bar producers can--and frequently do--roll bar-size shapes such as angles and channels, which are included in the summary on items 609.80 to 609.98, in this volume.

It is understood that hollow drill steel has not been produced in the United States recently; only two or three firms produced it previously.

U.S. production

U.S. production of hot-rolled iron and steel bars increased sharply following the economic slump in 1958 to about 7.8 million tons in each of the years 1959 and 1960 (table 1). After declining noticeably in 1961, production increased in each year to 1965, when it amounted to nearly 10.1 million tons, the largest quantity produced since 1953. Production declined by 2 percent in 1966 to 9.9 million tons. In the period 1958-66, bars of alloy steel constituted between 24 and 28 percent of the annual output. Data from the American Iron

and Steel Institute show annual production of hot-rolled bars, by type of steel, in 1958-66, as follows (in thousands of short tons):

Year	Iron and carbon steel	Alloy steel		Total
		Stainless	Other	
1958	4,612	68	1,434	6,114
1959	5,602	86	2,061	7,749
1960	5,768	87	1,897	7,752
1961	5,246	70	1,662	6,978
1962	5,707	73	2,077	7,857
1963	6,105	67	2,247	8,419
1964	6,955	63	2,631	9,650
1965	7,333	66	2,679	10,078
1966	7,236	68	2,554	9,858

The data shown for U.S. production of hot-rolled bars include bars produced from old rails, axles, and other reclaimed material, as follows:

	1,000 short tons		1,000 short tons
1958	207	1963	162
1959	224	1964	126
1960	208	1965	161
1961	121	1966	164
1962	125		

The great bulk of the bars produced from reclaimed material were probably of carbon steel.

As previously indicated, substantial quantities of hot-rolled bars are further processed by cold rolling, cold drawing, or other cold-finishing techniques. The production of cold-finished bars (including small quantities of cold-finished bar-size shapes) in 1958-66 was as follows:

	1,000 short tons		1,000 short tons
1958	1,167	1963	1,556
1959	1,569	1964	1,687
1960	1,561	1965	2,011
1961	1,308	1966	2,212
1962	1,484		

The average wholesale price of hot-rolled carbon steel bars, f.o.b. mill, as reported by the U.S. Bureau of Labor Statistics, increased from $6.675 per 100 pounds (in quantities of 20 tons or more) in December 1958 to $6.990 in December 1966, or by 4.7 percent; that for cold-finished bars increased from $10.710 to $11.154 during the same period, or by 4.1 percent.

U.S. exports

Until 1959, the United States was a net exporter of the iron and steel bars covered by this summary. In 1959, owing in large measure to the labor strike in the steel industry, the United States became a net importer of such bars and has remained so (table 1). In terms of tonnage, aggregate U.S. exports of iron and steel bars in 1958-66 were equal to only 31 percent of aggregate imports in the same period. Exports in 1966 accounted for less than 1 percent of total U.S. production.

U.S. exports in recent years have gone principally to Canada, India, Mexico, Peru, and Argentina (table 2). In 1965 and 1966 Canada accounted for about half of the total exports; more than 80 other foreign markets took the remainder. Recent U.S. exports have been financed in large part by the Agency for International Development.

U.S. exports of iron and steel bars, by kinds, for 1963-66 are shown in table 3. The product mix of the exports approximates that of domestic consumption.

U.S. imports

Notwithstanding depressed economic conditions in the United States during much of 1958, imports of the iron and steel bars included here were higher in that year (82,000 tons) than in any of the 4 immediately preceding years. Imports nearly tripled in the strike year of 1959 but declined in the 2 following years, amounting to 117,000 tons in 1961 (table 1). A sharp upward trend in the annual imports of bars began to develop in 1962; by 1966 the imports had increased to 592,000 tons, an amount more than 7 times that in 1958 and 4½ times that in 1962. Imports increased also in relation to domestic consumption, from 1.3 percent in 1958 to 5.7 percent in 1966.

Table 4 shows the imports included in this summary, by TSUS item number, in 1964-66. Carbon steel bars valued not over 5 cents per pound (item 608.45) accounted for 81 percent of the quantity of total imports in 1964, 78 percent in 1965, and 71 percent in 1966; their share of the value in those years was 60 percent, 59 percent, and 49 percent, respectively. U.S. imports of cold-finished bars (carbon and

alloy, included in items 608.50 and 608.52) comprised only a small part of the total imports--in 1966, about 6 percent of the tonnage. Products of alloy grades of iron and steel (items 608.32, 608.52, and 608.62) accounted for only about 2 percent of the total quantity in 1958 and for 7 to 10 percent in 1959-62. Although the quantity of imports of such alloy steel products continued to increase in the period 1963-65, it declined in relation to the total imports of products covered by this summary; in 1966, however, alloy steel products accounted for 10 percent of the total imports.

Total annual imports of bars of alloy steel (item 608.52) in 1964-66 and their alloy content subject to the additional duties provided in items 607.01 to 607.04 were as follows (in short tons):

	1964	1965	1966
Bars of alloy iron or steel, total--	17,915	33,632	56,587
Dutiable alloy content:			
Chromium (item 607.01)----------	826	1,212	1,501
Molybdenum (item 607.02)--------	166	188	236
Tungsten (item 607.03)----------	105	138	186
Vanadium (item 607.04)----------	51	77	83

Imports of alloy tool steel bars (including high-speed steel) increased from 3,605 tons in 1963, the first full year for which data were separately reported, to 6,296 tons in 1964, to 8,468 tons in 1965, and to 13,659 tons in 1966. Imports in 1964-66 of the bars reported under item 608.52, by type of alloy steel were as follows:

Type of alloy steel	1964		1965		1966	
	Quantity	Value	Quantity	Value	Quantity	Value
	Short tons	1,000 dollars	Short tons	1,000 dollars	Short tons	1,000 dollars
Not cold-formed:						
Stainless steel--	1,116	718	2,252	1,126	5,005	1,641
Tool steel:						
High-speed-----	1,199	1,810	1,832	2,003	1,910	2,444
Other----------	4,213	2,406	5,557	3,342	9,289	5,036
Other alloy steel---------	8,308	1,951	18,029	3,290	29,889	4,743
Cold-formed:						
Stainless steel--	1,375	919	2,467	1,685	2,902	1,961
Tool steel:						
High-speed-----	464	564	635	833	1,670	1,948
Other----------	420	378	444	439	790	456
Other alloy steel----------	820	248	2,416	741	5,132	1,102
Total--------	17,915	8,994	33,632	13,459	56,587	19,331

The United States depends on imports to meet virtually all its requirements for hollow drill steel. Imports of such steel products (items 608.60 to 608.62) rose from 4,757 tons in 1964 to 5,803 tons in 1965 and amounted to 5,424 tons in 1966. Alloy steel accounted for 40 to 43 percent of the annual imports of hollow drill steel in 1964-66.

Except for the fact that a substantial part of the imported steel bars, particularly those from Europe, are produced from steel made by the Thomas process, a process not used in the United States, imports are comparable in grade and quality to iron and steel bars produced domestically. Steel bars produced from Thomas steel, however, are not suitable for all uses.

Data on imports in 1964-66, by principal sources, are shown in table 5. Belgium and Luxembourg have been the principal source of imports, in terms of quantity, for many years. In 1966, aggregate imports of iron and steel bars, including hollow drill steel, from the European Economic Community (EEC) 1/ accounted for 62 percent of the total; and those from Japan, for 25 percent. Virtually all the 1966 imports from the EEC were of carbon steel, whereas 60 percent of those from Japan were of alloy steel. Imports of iron and steel bars from Austria and Sweden, countries that have a worldwide reputation for special-quality steels, are made principally from alloy steel. In 1966, 96 percent of the imports of bars from Sweden and 85 percent of those from Austria were of alloy steel.

Canada, the principal source of U.S. imports of hollow drill steel, accounted for 65 to 85 percent of such imports in 1964-66. The United Kingdom has supplied most of the recent imports of wrought-iron bars.

1/ Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany; imports from Italy and the Netherlands, which are not separately reported in table 5, were small in 1966.

Unit values of imported steel bars, computed from the values reported in the official U.S. statistics (generally the market values in the foreign country, hence excluding U.S. import duties, freight, and transportation insurance), vary widely, as indicated by the following tabulation of the average values per ton, by countries and types of product, in 1966:

Country	Steel bars			Hollow drill steel	
	Carbon steel		Alloy steel		
	Hot-rolled	Cold-finished		Carbon steel	Alloy steel
Austria	$93	$424	$740	$324	$533
Sweden	320	1,110	528	280	351
Japan	95	136	218	264	346
United Kingdom	127	164	516	290	394
Canada	161	154	414	342	492
West Germany	80	182	493	308	-
Belgium and Luxembourg	84	123	857	-	-
France	80	140	504	-	-
Average	88	141	342	324	446

Table 1.--Bars of iron and steel (except re-bars): U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

(Quantity in thousands of short tons; value in thousands of dollars)

Year	Production	Imports 1/	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1958	6,114	82	98	6,098	1.3
1959	7,749	222	53	7,918	2.8
1960	7,752	140	69	7,822	1.8
1961	6,978	117	76	7,020	1.7
1962	7,857	132	80	7,909	1.7
1963	8,419	224	72	8,571	2.6
1964	9,650	373	114	9,909	3.8
1965	10,078	561	129	10,510	5.3
1966	9,858	592	73	10,378	5.7
	Value				
1958	2/	7,510	19,963	2/	2/
1959	2/	24,264	12,643	2/	2/
1960	2/	20,400	17,933	2/	2/
1961	2/	15,171	20,152	2/	2/
1962	2/	18,239	21,721	2/	2/
1963	2/	27,033	21,458	2/	2/
1964	2/	42,545	29,336	2/	2/
1965	2/	64,313	34,592	2/	2/
1966	2/	69,931	24,644	2/	2/

1/ Data for the years 1958-63 are partly estimated.
2/ Not available.

Source: Production, from American Iron and Steel Institute; imports and exports compiled from official statistics of the U.S. Department of Commerce, except as noted.

Note.--Data shown are not strictly comparable in that the data on imports include smooth reinforcing bars (re-bars) and those on exports include bar-size shapes. Such imports and exports, however, are believed to be small.

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Table 2.--Bars of iron or steel (except re-bars): U.S. exports of domestic merchandise, by principal markets, 1963-66

Market	1963	1964	1965	1966
	Quantity (short tons)			
Canada	24,933	46,630	63,337	37,215
Mexico	4,650	6,144	7,597	6,650
India	10,862	27,550	26,174	5,078
Argentina	944	4,419	4,544	2,167
Italy	1,424	1,010	1,087	727
Peru	2,611	4,049	3,055	2,818
United Kingdom	373	1,327	585	716
Brazil	1,898	819	570	1,399
Australia	1,527	1,569	2,547	733
All other	1/ 22,947	2/ 20,432	19,183	15,419
Total	72,169	113,949	128,679	72,922
	Value (1,000 dollars)			
Canada	6,568	9,757	14,664	11,419
Mexico	1,332	1,871	2,231	2,157
India	3,115	7,247	7,083	1,602
Argentina	408	1,416	1,586	754
Italy	1,239	789	983	643
Peru	476	772	732	569
United Kingdom	227	602	394	522
Brazil	550	273	218	504
Australia	751	858	851	353
All other	1/ 6,792	2/ 5,751	5,850	6,121
Total	21,458	29,336	34,592	24,644

1/ Includes 3,980 tons, valued at 1,046 thousand dollars, to Thailand and 1,991 tons, valued at 735 thousand dollars, to Pakistan.

2/ Includes 3,318 tons, valued at 926 thousand dollars, to Pakistan.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Bars of iron or steel (except re-bars): U.S. exports of domestic merchandise, by kinds, 1963-66

Kind	1963	1964	1965	1966
	Quantity (short tons)			
Iron and carbon steel:				
Hot-rolled only	47,269	71,119	77,312	41,204
Cold-finished	8,014	13,167	14,298	12,085
Stainless steel:				
Hot-rolled only	1,357	1,639	2,047	1,756
Cold-finished	1,473	1,429	3,084	1,641
Alloy steel other than stainless:				
Hot-rolled only	10,232	19,702	25,559	12,678
Cold-finished	2,079	4,614	4,727	1,779
Tool steel (all grades) 1/	1,746	2,279	1,652	1,779
Total	72,169	113,949	128,679	72,922
	Value (1,000 dollars)			
Iron and carbon steel:				
Hot-rolled only	9,105	12,114	14,192	8,316
Cold-finished	2,543	3,692	4,101	3,806
Stainless steel:				
Hot-rolled only	1,413	1,628	2,016	1,602
Cold-finished	1,685	1,619	2,217	2,074
Alloy steel other than stainless:				
Hot-rolled only	3,192	5,386	7,051	5,623
Cold-finished	1,077	1,906	2,279	1,041
Tool steel (all grades) 1/	2,443	2,990	2,736	2,182
Total	21,458	29,336	34,592	24,644

1/ Consists predominantly of alloy steels.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Bars of steel (except deformed re-bars) and wrought iron: U.S. imports for consumption, by TSUS item number, 1964-66

TSUS item	1964		1965		1966	
	Quantity	Value	Quantity	Value	Quantity	Value
	Short tons	1,000 dollars	Short tons	1,000 dollars	Short tons	1,000 dollars
608.30	248	71	262	81	484	138
608.32	-	-	-	-	1/	2/
608.45	302,942	25,394	439,396	37,972	425,296	34,503
608.46	29,416	3,686	57,584	7,042	74,840	9,708
608.48	4,464	641	6,106	907	6,883	981
608.50	13,134	1,770	18,142	2,553	22,978	3,238
608.52	17,915	8,994	33,632	13,459	56,587	19,331
608.60	46	7	24	4	-	-
608.61	2,815	980	3,259	1,081	3,132	1,020
608.62	1,896	1,002	2,520	1,241	2,268	1,012
Total	372,876	42,545	560,925	64,313	592,468	69,931

1/ Less than 1/2 ton.
2/ Less than $500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 5.--Bars of steel (except deformed re-bars) and wrought iron: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Japan	52,156	112,486	150,163
Belgium and Luxembourg	205,527	235,997	212,508
West Germany	44,163	97,832	105,850
Canada	15,192	16,717	26,122
United Kingdom	19,117	38,698	30,206
France	28,931	40,604	41,803
Austria	2,359	3,821	5,430
Sweden	4,454	6,106	6,511
All other	977	8,664	13,873
Total	372,876	560,925	592,468
	Value (1,000 dollars)		
Japan	7,312	15,316	19,841
Belgium and Luxembourg	17,447	20,718	17,616
West Germany	3,823	8,701	9,029
Canada	4,542	4,929	6,928
United Kingdom	3,049	4,978	4,504
France	2,682	3,833	3,869
Austria	1,469	2,353	3,663
Sweden	2,068	2,726	3,374
All other	153	759	1,107
Total	42,545	64,313	69,931

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Wire rods:	
Other than alloy iron or steel---	608.70, -.71, -.73, -.75
Alloy iron or steel----------	608.76, -.78

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

U.S. consumption of wire rods, which has been increasing in recent years, reached 6.4 million short tons in 1966. Annual imports, which rose sixfold from 1958 to 1965, constituted 20 percent of apparent consumption in 1965 and 18 percent in 1966. In 1965, imports were equivalent in quantity to 25 percent of domestic production and to almost 50 percent of the rods consumed by independent wire drawers and fabricators. In recent years exports have been insignificant.

Description and uses

For tariff purposes, wire rods are a "coiled, semifinished, hot-rolled product of solid cross section, approximately round in cross section, not under 0.20 inch nor over 0.74 inch in diameter"; see headnote 3(f) to part 2B of schedule 6. Wire rods are produced from billets that have been heated to the appropriate rolling temperature and then passed through a series of reducing and forming rolls until the desired diameter is reached--from about 7/32 inch (0.2187) to about 47/64 inch (0.734). The rods are laid in coils as they leave the last stand of rolls. Substantial tonnages are shipped in the "as rolled" condition; some are pickled and lime-coated, or oiled, to prevent (or retard) corrosion in transit and to facilitate drawing. Wire rods subjected to treatments to improve the properties or appearance of the metals or to protect them against rusting, corrosion, or other deterioration, as described in headnote 1 to part 2 of schedule 6, are included in the TSUS items discussed in this summary. These treatments include annealing, tempering, rough coating, polishing, and burnishing.

Wire rods are used principally for fabricating (by drawing) wire (see the following summary in this volume). Wire rods have few other uses, the most significant of which is for reinforcing concrete.

The bulk of the steel rods used in the United States are carbon steel (i.e., other than alloy steel) with a low or medium-low carbon

content. The low-carbon rods (by weight up to 0.25 percent carbon)--the more important in terms of volume--are used in the production of wire for nails, barbed wire, various types of fencing and netting, garment hangers, building mesh for reinforcing concrete, and for a myriad of household wire articles. The low- and medium-low-carbon grades of rods, as well as the higher carbon and alloy grades (notably stainless steel and tool steel) are used to make fine and specialty wire for bookbinding, staples for fastening paper and cardboard, welding rods, screws, springs, strand, rope and cable, chain, industrial fasteners, pins, jewelry, and other wire products requiring special properties.

The type of steelmaking process used to produce the raw steel is important with regard to wire rods destined for certain applications. For example, imported wire rods made from steel produced by the Thomas process, a process widely used in Europe but not at all in the United States, are less suitable for wire requiring substantial reduction or for wire that will be subject to severe deformation either in the production of the finished product or in its use as wire. The kind of rolling operations used to produce the wire rods may also affect their applications. Wire rods imported from Sweden are preferred by some domestic producers of high-quality specialty wire because they are virtually free of a longitudinal roll seam generally more apparent in most domestic and imported rods. Most of the rods produced in the United States are made from steel produced by the basic open-hearth process, but substantial quantities are also made from steel produced by other processes (see the summary in this volume on items 608.15 to 608.18).

In this summary all quantities are expressed in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Wire rods:	
	Other than alloy iron or steel:	
	Not tempered, treated, or partly manufactured, and valued per pound--	
608.70	Not over 4 cents----------	0.1¢ per lb.
608.71	Over 4 cents----------	0.25¢ per lb.
	Tempered, treated, or partly manufactured, and valued per pound--	
608.73	Not over 4 cents----------	0.2¢ per lb.
608.75	Over 4 cents----------	0.375¢ per lb.
	Alloy iron or steel:	
608.76	Not tempered, treated, or partly manufactured.	0.25¢ per lb. + 4% ad val. 1/
608.78	Tempered, treated, or partly manufactured.	0.375¢ per lb. + 4% ad val. 1/

1/ Plus additional duties as provided under items 607.01 to 607.04 (see appendix A).

These rates, which reflect trade-agreement concessions granted by the United States in the General Agreements on Tariffs and Trade, were derived principally from the rates for wire rods in paragraph 315 of the former tariff schedules. Before August 31, 1963, the effective date of the TSUS, wire rods of alloy iron or steel were also subject to additional duties under paragraph 305. The implementation of the TSUS did not result in any significant rate changes for the articles considered here. For virtually all the articles included in items 608.70 and 608.73, the current rates became effective on July 1, 1963, and for most of the articles included in the other items here considered, the current rates became effective on June 30, 1958.

On the 1966 imports of wire rods, the ad valorem equivalents of the duty (exclusive of the additional specific duties on alloy content as provided under items 607.01 to 607.04) were as follows:

TSUS item	Percent	TSUS item	Percent
608.70----------	2.7	608.75----------	5.8
608.71----------	4.8	608.76----------	6.8
608.73----------	5.4	608.78----------	5.9

For a discussion of the additional duties on alloy content, see the general statement on the provisions of subpart 2B of schedule 6.

In 1963 the Tariff Commission completed four investigations on wire rods under the provisions of section 201(a) of the Antidumping Act, 1921, as amended. These investigations were instituted in response to advice from the Treasury Department that hot-rolled carbon steel wire rods produced by certain firms in Belgium, Luxembourg, West Germany, and France were being, or were likely to be, sold in the United States at less than fair value, within the meaning of the Antidumping Act. In each case, the Commission found unanimously that an industry in the United States was not being or was not likely to be injured by sales of hot-rolled carbon steel wire rods at less than fair value. 1/ Therefore, the Secretary of the Treasury did not issue a "finding of dumping" on wire rods from the countries named above.

U.S. consumption

The apparent annual U.S. consumption of wire rods has trended upward since 1958, when it amounted to about 4.5 million tons. Consumption increased annually from about 4.8 million tons in 1961 to 6.4 million tons in 1966 (table 1). During this recent upward trend, 1964 was the first year in which domestic consumption exceeded the annual average for 1953-57.

The principal consumers of wire rods are the integrated steelmaking concerns that make wire rods and also draw wire. Their annual consumption of wire rods has been between 3.4 million and 3.9 million tons in recent years. The consumption of wire rods by independent fabricators, on the other hand, is estimated to have been about 1.3 million tons in 1958 and to have increased from about 1.6 million tons in 1961 to 2.5 million tons in 1966. The independent fabricators' share of total annual consumption rose from nearly 30 percent in 1958 to about 40 percent in 1963-66.

The increased consumption by independent fabricators, both in terms of quantity and in relation to total consumption, resulted in part from the trend of wire-product manufacturers toward vertical integration of their operations. During the last several years, many of these concerns installed wire-drawing equipment; such firms now purchase wire rod and draw wire of appropriate diameter as needed for their finished products. Since the wire used is produced as needed, the integrated fabricators are able to operate with reduced inventories of wire.

1/ U.S. Tariff Commission Publications 93, 94, 95, and 99, all issued in 1963.

Domestic producers

Although about 30 concerns regularly operate facilities for the production of wire rods, 3 integrated steel concerns probably account for more than half of the domestic capacity. Rod mills are located in about 41 cities in 17 States; Illinois, Pennsylvania, and Ohio have about three-fifths of the total annual production potential. While most domestic producers offer a wide variety of wire rods in terms of composition and size, several producers limit their output to high-quality, special-purpose grades of carbon and alloy steel. With appropriate accessory equipment, rod mills may be utilized to produce other rolled products, particularly concrete reinforcing bars. Virtually all domestic producers of rods also have facilities for the production of wire; most of them produce a variety of wire products, such as fencing, nails, reinforcing mesh, and specialty wire.

U.S. production and shipments

Although annual U.S. production of wire rods of iron and steel has increased since 1960, output in 1966--5.3 million tons--was still below the average annual output during 1947-56--5.4 million tons. Nearly all the production consists of wire rods of carbon steel, those of low-carbon content (by weight up to 0.25 percent carbon) predominating. Wire rods of alloy steel constitute only 2 to 4 percent of the annual U.S. output.

Between 70 and 75 percent of annual domestic output of wire rods is consumed by the producing concerns. Domestic producers' annual shipments of wire rods have trended upward since 1958, as indicated by the following data reported by the American Iron and Steel Institute:

	1,000 short tons		1,000 short tons
1958----------	1,166	1963----------	1,292
1959----------	1,283	1964----------	1,496
1960----------	1,113	1965----------	1,517
1961----------	1,173	1966----------	1,563
1962----------	1,228		

High-quality, special-purpose wire rods probably constitute a larger proportion of shipments than of production. About 45 percent of total shipments in 1966 went to converters and processors, principally independent wire and wire-product fabricators; 21 percent, to domestic producers of bolts, nuts, rivets, and screws; 18 percent, to producers of machinery, industrial equipment, and tools; 5 percent, to producers of contractors' products and the construction industry; and 5 percent, to the automotive industry. The remaining 6 percent consisted of smaller shipments to many other types of consumers.

U.S. exports

Before the 1950's U.S. exports of wire rods greatly exceeded imports. Since 1953, however, the relationship has been reversed. The 34,000 tons exported in 1964 represents the high for the 17-year period 1950-66. In 1965, 19,000 tons was exported and in 1966, 12,000 tons (table 1).

Export markets have varied considerably from year to year. During the late 1950's, Canada, Israel, and the Republic of South Africa were the principal foreign markets. More recently, India, Viet-Nam, Canada, and Japan have received the bulk of the U.S. exports of wire rods (table 2).

U.S. imports

Annual U.S. imports of wire rods of iron or steel increased almost without interruption from 177,000 tons, valued at $17.8 million, in 1958 to 1,284,000 tons, valued at $123.5 million, in 1965 (table 1). Imports amounted to 1,150,000 tons, valued at $108.0 million dollars, in 1966. The 252,000-ton rise in imports from 1958 to 1959 resulted principally from the extended labor strike in the domestic steel industry in that year and the 331,000-ton rise from 1964 to 1965 was due in part to the strike threat during 1965. Other year-to-year changes in imports during the period 1958-66 ranged from 39,000 tons (the decrease from 1959 to 1960) to 180,000 (the increase from 1961 to 1962).

The Western European countries, particularly France, West Germany, Belgium and Luxembourg, Sweden, and the United Kingdom have long been important sources of U.S. imports of wire rods of iron or steel (table 3). After 1958, however, Japan became increasingly important as the major source; in 1963-66 that country accounted for about 50 percent of the total tonnage of U.S. imports of wire rods. Australia, Argentina, and the Republic of South Africa, countries not historically considered to be major factors in world steel production, have recently been noteworthy sources of imports.

Following World War II and continuing through 1954, imports from all sources consisted principally of wire rods valued at not over 4 cents per pound. From 1955 through 1961 the share of annual imports consisting of rods valued over 4 cents per pound increased, amounting to 95 percent of the tonnage in 1961. There was a notable decline in the average unit value of imported wire rods from 1961 to 1964. In 1964 rods valued not over 4 cents per pound (items 608.70 and 608.73) constituted nearly half of the total U.S. imports of wire rods (table 4). In 1965 the average unit value of imports increased, and almost three-fourths of the total imports were valued over 4 cents per pound

(items 608.71 and 608.75); in 1966 the situation was again reversed and the lower valued rods were about two-thirds of total imports. For the most part, these variations in the composition of U.S. imports reflect fluctuations in foreign exporters' prices and, to a lesser extent, changes in the grades or types of rods being imported.

Although the common grades of carbon steel rods have made up the bulk of the imports of wire rods, imports of the more sophisticated, special-purpose rods have increased in recent years. Imports of tempered rods and of alloy steel rods (items 608.73 to 608.78) have constituted an increasing share of total imports, reaching 7 percent in 1966. A large share of the recent imports from Sweden have consisted of excellent-quality high-carbon steel wire rods, which are preferred by many in the United States for drawing wire to be used in the manufacture of precision and durable springs and for other special applications. In recent years wire rods of alloy steel (items 608.76 and 608.78) have constituted about the same proportion of total imports of wire rods as of production--2 to 3 percent. From 1964 to 1966, imports of stainless steel rods increased from 8,075 tons to 12,691 tons; imports of alloy tool-steel rods (including those of high-speed steel), from 1,865 tons to 3,097 tons; and those of other alloy steel rods, from 8,566 tons to 27,414 tons. Imports of alloy steel rods, by type, in 1964-66 were as follows:

Type of alloy steel	1964		1965		1966	
	Quantity	Value	Quantity	Value	Quantity	Value
Not tempered, treated, or partly manufactured:	Short tons	1,000 dollars	Short tons	1,000 dollars	Short tons	1,000 dollars
Stainless steel--	345	255	325	203	974	408
Tool steel:						
High-speed-----	6	8	1/	2/	75	11
Other----------	228	49	894	164	1,850	283
Other alloy steel----------	7,133	1,357	8,952	1,584	12,413	2,060
Tempered, treated, or partly manufactured:						
Stainless steel--	7,730	5,036	8,749	5,294	11,717	7,412
Tool steel:						
High-speed-----	85	112	254	301	525	672
Other----------	1,546	403	2,881	739	647	149
Other alloy steel----------	1,433	319	7,785	1,568	15,001	2,898
Total------	18,506	7,539	29,840	9,853	43,202	13,893

1/ Less than 1/2 ton. 2/ Less than $500.

The ratio of imports to total U.S. consumption of wire rods (including rods consumed by producers themselves) increased significantly from 4 percent in 1958 to 9 percent in 1961 and to 20 percent in 1965; it was 18 percent in 1966 (table 1). In 1965, imports of wire rods were equivalent to 25 percent of domestic production, 96 percent of shipments by domestic producers, and 50 percent of the wire rods consumed by independent wire drawers and fabricators.

In 1964 the unit value of imported wire rods, computed from the values reported in the official statistics, 1/ ranged widely, from 2.5 cents to $1.30 a pound, and averaged about 4.6 cents. It is estimated that the sales value of domestically produced rods f.o.b. mill averaged between 7.0 and 7.5 cents a pound during the same year. Part of this difference between the f.o.b. values of imports and those of domestic products reflects the fact that a substantially greater portion of the imports consisted of the low grades of wire rods. Rods made from Thomas steel, which constitute much of the volume imported from European countries, do not command as high a price as do similar rods produced from open-hearth steel.

Imported wire rods compete directly with domestically produced rods throughout a very substantial part of the United States. In 1964, east coast ports (except those in Florida) handled about 33 percent of the total volume of the imports of wire rods; ports in Florida and those in the customs districts bordering the Gulf of Mexico, about 30 percent; ports on or near the Great Lakes, 24 percent; and west coast ports, the remainder. Imported wire rods consigned to consumers in the North Central States apparently compete with locally produced rods throughout the year, notwithstanding that the Great Lakes are closed to traffic during the colder months, when imports are transshipped from gulf or east coast ports.

Foreign production and trade

Since World War II, production of wire rods has increased considerably in many countries; the rise in Japan's output is an outstanding example. Japan's production of iron and steel wire rods, which averaged only 490,000 short tons a year during 1936-38 (the peak period of production prior to World War II), amounted to 938,000 tons in 1958 and rose to 3,058,000 tons in 1965 and to 3,149,000 tons in 1966. In certain

1/ Generally the market values in the foreign country; therefore they exclude U.S. import duties, freight, and transportation insurance.

other countries supplying the U.S. market in recent years, production of wire rods in 1958, 1964, and 1965 was as follows (in thousands of short tons):

	1958	1964	1965
West Germany	1,890	3,049	3,161
France	1,232	2,001	2,106
United Kingdom	1,271	1,888	1,954
Belgium and Luxembourg	787	1,200	1,295
Italy	472	609	743
Sweden	201	317	307

Without exception, the countries listed above have exported a larger proportion of their production of wire rods in recent years than has the United States. This is probably true also of many other countries that are newcomers as steel producers. As noted in the section on imports, Australia, Argentina, and the Republic of South Africa, which are becoming sizable producers of steel wire rods, have been among the principal suppliers of U.S. imports in recent years. For the United States, Japan, and the countries listed in the preceding tabulation, the ratios of both imports and exports to production in 1965 are shown below:

Country	Imports		Exports	
	Quantity	Ratio of imports to production	Quantity	Ratio of exports to production
	1,000 short tons	Percent	1,000 short tons	Percent
United States	1,284	25	19	1/
Japan	2/ 2	1/	818	27
West Germany	603	19	603	19
France	170	8	968	46
United Kingdom	37	2	84	4
Belgium and Luxembourg	194	15	593	45
Italy	57	8	73	10
Sweden	101	33	116	38

1/ Less than 0.5 percent. 2/ Estimated.

About three-fourths of Japan's total exports of wire rods in 1965 were shipped to the U.S. market; in the aggregate almost two-fifths of the exports of the countries listed here were imported into the United States in that year.

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Table 1.--Wire rods of iron or steel: U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

(Quantity in thousands of short tons; value in thousands of dollars)

Year	Production 1/	Imports 2/	Exports	Apparent consumption 1/	Ratio (percent) of imports to consumption
	Quantity				
1958	4,342	177	17	4,502	3.9
1959	4,628	429	4	5,052	8.5
1960	4,265	390	10	4,645	8.4
1961	4,416	436	5	4,847	9.0
1962	4,435	616	17	5,034	12.2
1963	4,627	778	24	5,381	14.5
1964	4,871	953	34	5,790	16.5
1965	5,081	1,284	19	6,346	20.2
1966	5,303	1,150	12	6,441	17.9
	Value				
1958	3/	17,789	2,380	3/	3/
1959	3/	42,368	465	3/	3/
1960	3/	43,754	1,327	3/	3/
1961	3/	45,660	1,893	3/	3/
1962	3/	57,742	3,854	3/	3/
1963	3/	73,317	4,146	3/	3/
1964	3/	88,456	5,717	3/	3/
1965	3/	123,526	3,145	3/	3/
1966	3/	108,021	2,269	3/	3/

1/ Includes intermediate production (or consumption) of wire rods by fully integrated producers of rod and wire.
2/ Data for 1958-63 are partly estimated.
3/ Not available.

Source: Production, from American Iron and Steel Institute; imports and exports, compiled from official statistics of the U.S. Department of Commerce.

Table 2.--Wire rods of iron or steel: U.S. exports of domestic merchandise, by principal markets, 1963-66

Market	1963	1964	1965	1966
	Quantity (short tons)			
Canada	734	1,199	1,253	4,883
Japan	88	469	862	1,215
South Viet-Nam 1/	1,944	5,216	3,971	3,635
India	17,371	25,146	12,049	1,192
All other	2/ 3,896	1,909	1,056	1,264
Total	24,033	33,939	19,191	12,189
	Value (1,000 dollars)			
Canada	195	260	292	784
Japan	42	222	414	624
South Viet-Nam 1/	209	442	324	289
India	3,020	4,441	1,736	214
All other	2/ 680	352	379	358
Total	4,146	5,717	3,145	2,269

1/ In the U.S. statistics trade with South Viet-Nam was separately reported beginning in 1966.

2/ Includes 2,584 tons, valued at 384 thousand dollars, to Pakistan.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Wire rods of iron or steel: U.S. imports for consumption, by principal sources, 1963-66

Country	1963 1/	1964	1965	1966
	Quantity (short tons)			
Japan	406,466	452,371	642,457	609,860
France	88,236	146,891	214,396	209,677
West Germany	86,651	117,886	164,180	119,353
Sweden	20,872	25,478	28,353	33,946
Belgium and Luxembourg	36,424	66,799	108,076	90,812
United Kingdom	57,670	55,936	48,938	31,934
Australia	5,758	2,331	2,604	18,451
Argentina	34,716	44,948	12,784	19,005
Republic of South Africa	30,873	10,289	-	10,288
All other	10,300	29,837	61,847	6,983
Total	777,966	952,766	1,283,635	1,150,309
	Value (1,000 dollars)			
Japan	36,468	39,545	60,461	54,845
France	8,472	12,886	19,267	18,367
West Germany	7,022	10,327	14,928	9,806
Sweden	5,022	6,545	7,088	8,931
Belgium and Luxembourg	2,719	4,979	8,663	7,197
United Kingdom	6,855	6,880	6,513	4,019
Australia	453	176	208	1,484
Argentina	2,739	3,612	1,146	1,410
Republic of South Africa	2,350	835	-	772
All other	1,217	2,671	5,252	1,190
Total	73,317	88,456	123,526	108,021

1/ Partly estimated.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Table 4.--Wire rods of iron or steel: U.S. imports for consumption, by TSUS items, 1964-66

TSUS item	1964	1965	1966
	Quantity (short tons)		
608.70	474,662	329,706	731,849
608.71	435,783	881,355	339,317
608.73	510	119	62
608.75	23,305	42,615	35,879
608.76	7,712	10,171	15,312
608.78	10,794	19,669	27,890
Total	952,766	1,283,635	1,150,309
	Value (1,000 dollars)		
608.70	35,676	25,605	54,374
608.71	42,499	83,000	35,113
608.73	40	9	5
608.75	2,702	5,059	4,636
608.76	1,669	1,951	2,762
608.78	5,870	7,902	11,131
Total	88,456	123,526	108,021

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Flat wire	609.20, -.21, -.22, -.25, -.26, -.27, -.30, -.31, -.32, -.35, -.36, -.37
Round wire	609.40, -.41, -.43, -.45
Other wire	609.70, -.72, -.75, -.76

Note.--For the statutory description see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p.23.

U.S. trade position

In the United States, the world's largest consumer, producer, and importer of iron or steel wire, imports have been equivalent in recent years to about 6 percent of total consumption of such wire. For some grades of iron or steel wire, however, the ratio of imports to consumption is much larger. Exports have always accounted for an extremely small portion of domestic production.

Description and uses

Iron or steel wire is classified in the TSUS principally by its cross-sectional configuration and dimensions and by the type of iron or steel used in its manufacture. The term "wire" is defined in headnote 3(i) to part 2B of schedule 6 as "a finished, drawn, nontubular product, of any cross-sectional configuration, in coils or cut to length, and not over 0.703 inch in maximum cross-sectional dimension." The term "wire" also includes a product of "solid rectangular cross section, in coils or cut to length, with a cold-rolled finish, and not over 0.25 inch thick and not over 0.50 inch wide." The term "flat wire" applies not only to this cold-rolled product but also to drawn wire of rectangular cross section.

Round wire, which has a circular cross-section, is by far the principal type of wire produced and the most important type considered in this summary. "Other" wire, which is generally referred to as shape wire, is cold-drawn in a wide variety of cross-sectional configurations (except rectangular or circular), many of which are designed for use in the production of specific products.

The wire included in this summary may be subjected to treatments to improve the properties or appearance of the iron or steel or to protect it against rusting, corrosion, or other deterioration; see headnote 1 to part 2 of schedule 6 (in appendix A). For example, wire

is often zinc-coated (galvanized) or aluminum-coated to render it corrosion-resistant, or it may be tin- or copper-coated to enhance its appearance. Not included here are milliners' wire and other wire covered with textiles, plastics, or other material not wholly of metal (items 642.96 and 642.97), wire strands, ropes, cables, and cordage (items 642.06 to 642.21), and barbed wire (item 642.02), all of which are discussed in volume 6:5.

The most common method of producing wire is by cold-drawing wire rods (discussed in the preceding summary of this volume) which were previously cleaned with acid, rinsed, and then coated with lime, borax, or other suitable material. The coating material neutralizes any remaining acid, prevents rusting, and aids in the lubrication of the wire rods as they are drawn through one die, or continuously through a series of dies, each designed to further reduce the cross-sectional dimensions of the wire. Wire is generally "dry-drawn" from limed rods with the use of a soapy solution or grease as a lubricant. For certain special purposes, wire is dry-drawn to an intermediate size, then lightly coated with copper, tin, or other appropriate metal or alloy before being "wet-drawn" to its finished size.

Most flat wire is cold-rolled from scale-free wire rods or from drawn wire and is not over 0.25 inch thick and not over 0.50 inch wide. Some flat wire is produced by slitting cold-rolled plate, sheet, or strip, a method often used to produce flat wire which measures significantly more in width than in thickness. Cold-rolled products over 0.50 inch in width, however, are classified for tariff purposes either as bars or as plates, sheets, or strip and are discussed in other summaries of this volume.

The cold reduction of steel by rolling or drawing increases its hardness and tensile strength but reduces its ductility. Accordingly, wire cannot be drawn through a long series of dies without intermediate heat treatment to relieve the stresses induced by cold working and to restore ductility. The mechanical properties of high-carbon steels are more readily affected by cold working than are those of low-carbon steels; therefore more frequent heat treatments may be necessary before a wire of high-carbon steel has been drawn to its finished size. By altering the drawing and heat-treating operations, wire of various mechanical properties can be made from wire rod of a particular chemical composition. The most widely used heat-treating process in the wire industry is annealing, which renders the metal less brittle. Patenting, a heat-treating process peculiar to wire manufacturing, is generally used in treating high-carbon steel wire to obtain a combination of high ductility and high strength. Hardening and tempering treatments are widely used to obtain the characteristics necessary to avoid permanent deformations in wire used in springs and other products where its service is severe.

The applications of iron or steel wire are myriad. Among the items fabricated from flat wire are flat springs, umbrella ribs and stretchers, wire brushes, blades for small saws, certain saw frames, banding material, and box and paper staples. Round and shape wire are used to reinforce the bead on pneumatic tires, as welding rods, in baling operations, and for making wire fencing, wire nails, concrete reinforcing fabric, insect screening, wire cloth, cotter pins, dressmaker and safety pins, wheel spokes, chain, bolts, nuts, screws, rivets, washers, strand, rope, cable, garment hangers, cages, shopping carts, and coil springs.

Many of the products mentioned above are made from various grades of carbon and alloy iron or steel. For many of the common applications of wire, specifications for the grade of iron or steel, as well as for the cross-sectional configurations and dimensions, have been standardized. The standards for identified "types" of wire, however, are not mutually exclusive, i.e., the standard specifications for a particular application may be suitable for other applications. In commerce it is often the practice to refer to wire by its known intended use, for example, cotter-pin wire, clothes-pin wire, safety-pin wire, box-binding wire, paper-clip wire, piano wire, rope wire, tire-bead wire, and valve-spring wire.

In this summary all quantities are expressed in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Flat wire:	
	Other than alloy iron or steel:	
	Not coated or plated with metal:	
609.20	Not over 0.01 inch thick	6% ad val.
609.21	Over 0.01, not over 0.05 inch thick	8.5% ad val.
609.22	Over 0.05 inch thick	10% ad val.
	Coated or plated with metal:	
609.25	Not over 0.01 inch thick	0.1¢ per lb. + 6% ad val.
609.26	Over 0.01, not over 0.05 inch thick	0.1¢ per lb. + 8.5% ad val.
609.27	Over 0.05 inch thick	0.1¢ per lb. + 10% ad val.
	Alloy iron or steel:	
	Not coated or plated with metal:	
609.30	Not over 0.01 inch thick	10% ad val. 1/
609.31	Over 0.01, not over 0.05 inch thick	12.5% ad val. 1/
609.32	Over 0.05 inch thick	14% ad val. 1/
	Coated or plated with metal:	
609.35	Not over 0.01 inch thick	0.1¢ per lb. + 10% ad val. 1/
609.36	Over 0.01, not over 0.05 inch thick	0.1¢ per lb. + 12.5% ad val. 1/
609.37	Over 0.05 inch thick	0.1¢ per lb. + 14% ad val. 1/
	Round wire:	
	Other than alloy iron or steel, in diameter--	
609.40	Under 0.060 inch	8.5% ad val.
	0.060 inch or more, by weight--	
609.41	Not over 0.25 percent carbon	0.3¢ per lb.
609.43	Over 0.25 percent carbon	8.5% ad val.
609.45	Alloy iron or steel	12.5% ad val. 1/
	Other wire:	
	Other than alloy iron or steel:	
609.70	Not coated or plated with metal	12.5% ad val.
609.72	Coated or plated with metal	0.1¢ per lb. + 12.5% ad val.
	Alloy iron or steel:	
609.75	Not coated or plated with metal	16.5% ad val. 1/
609.76	Coated or plated with metal	0.1¢ per lb. + 16.5% ad val. 1/

1/ Plus additional duties as provided under items 607.01 to 607.04 (see appendix A).

These rates reflect concessions granted by the United States in the General Agreement on Tariffs and Trade. In the pre-TSUS tariff schedules, iron or steel wire was subject, under the provisions of paragraphs 315, 316(a), and 317, to many different rates of duty; if of alloy iron or steel, wire was also subject to additional duties under paragraph 305. For the flat wire now in items 609.20 to 609.22, 609.27, and 609.32 to 609.37, the current rates have been in effect since July 1, 1963, and for virtually all the types of flat wire now in items 609.25, 609.26, 609.30, and 609.31, the current rates have been in effect since June 30, 1958. For nearly all the types of shape wire now in items 609.70 to 609.76, the current rates have been applicable since June 6, 1951.

Round iron or steel wire was dutiable under the pre-TSUS tariff schedules at a variety of rates, depending on value, diameter, composition, finish, and end use. In the TSUS initially adopted on August 31, 1963, the many competing tariff provisions for round wire of nonalloy iron or steel were consolidated into two provisions (items 609.40 and 609.42), based solely on wire diameter and establishing rates representing the weighted averages of the former rates. For round wire 0.060 inch or more in diameter and containing over 0.25 percent by weight of carbon (in item 609.42), the weighted average--0.3 cent per pound--resulted unintentionally in a substantial rate reduction. Accordingly, effective December 7, 1965, the TSUS was amended, pursuant to Public Law 89-241, by establishing items 609.41 and 609.43 (as shown in the foregoing tabulation) to replace item 609.42. The current rate for round wire of alloy iron or steel is the same as the rate applicable since June 30, 1958, to such wire valued at more than 6 cents per pound.

The ad valorem equivalents of the 0.1-cent-per-pound component of the rates of duty applicable to coated or plated flat and shape wire ranged from 0.3 to 0.9 percent, based on the imports in 1966. The corresponding average ad valorem equivalent of the 0.3-cent-per-pound rate provided for low-carbon steel round wire of 0.060 inch or more in diameter (item 609.41, which composed nearly half of the tonnage of wire imported in 1966) was 4.9 percent. Data are not reported in a manner that permits the computation of the ad valorem equivalents of the additional duties on alloy content of wire as provided under items 607.01 to 607.04; see the general statement on the provisions of subpart 2B of schedule 6. In 1966, wire of alloy iron or steel constituted only 4.4 percent of the total imports of iron or steel wire.

U.S. consumption

U.S. consumption of iron or steel wire has trended upward in recent years, rising from 4.6 million tons in 1958 to 6.7 million in

1965 and to about 6.9 million in 1966 (table 1); 1965 was the first year in which wire consumption was higher than in 1951. The unusually large increase in apparent consumption from 1958 to 1959--702,000 tons--reflected a buildup of consumer inventories to an abnormal level in anticipation of a labor walkout in steel mills. The foregoing consumption data include wire used in the manufacture of end products by both wire producers and others.

Imports of iron or steel wire have supplied an increasing percentage of the total domestic consumption of all grades of such wire in recent years; the share increased from 3.5 percent in 1958 to 6.4 percent in 1964 and 1965 and to 6.6 percent in 1966. With respect to wire of alloy iron or steel, which constitutes about 3 to 5 percent of annual imports of the wire considered here, imports supplied a higher percentage of consumption. In 1966, total imports of alloy iron or steel wire constituted 9 percent of consumption; those of stainless steel wire alone, 12 percent; and those of wire of other types of alloy iron or steel, about 6 percent.

U.S. producers

Two types of producers manufacture iron or steel wire in the United States: (1) Integrated and semi-integrated steel concerns that produce wire from steel made within their own organization, and (2) independent wire-drawing concerns that produce wire from purchased rods or, much less frequently, from purchased billet. All of the steel producers and many of the wire-drawing concerns fabricate one or more finished wire products, as well as sell wire to other fabricating concerns.

About 25 to 28 integrated or semi-integrated concerns make wire from rods produced in their own mills. These firms produce the great bulk of the rolled flat wire made in the United States--that rolled from rod and wire and that produced from plate, sheet, and strip. About 8 of the integrated concerns operate 2 or more wire-producing facilities. According to the U.S. Department of Commerce, 198 wire-drawing establishments were operating in the United States in 1963; about 50 of these were operated by either integrated or semi-integrated steel producers. The number of independent concerns has increased in recent years, many product fabricators having installed wire-drawing equipment of their own. Apparently these concerns find it more economical to purchase either domestic or imported wire rods and convert them into wire as needed than to maintain an inventory of wire of the many different diameters and properties that may be required.

The independent wire-drawing concerns range in size from very small establishments oriented to a single, often simple, product to

organizations of moderate size completely equipped with cleaning, drawing, heat-treating, and coating facilities that produce a wide variety of wire and wire products. While wire and wire products have constituted only about 4 percent of all products shipped by the steel producers, such articles have been virtually the only products shipped by many of the independent concerns. In terms of value, total annual shipments of wire and wire products are probably about evenly divided between the two groups of producers.

According to the U.S. Department of Commerce, between 20,000 and 25,000 persons were employed in domestic wire-drawing establishments in 1963. Although a third of the establishments and two-fifths of the workers employed are located in the industrial North Central States, the industry is widespread geographically.

U.S. production and shipments

The data shown in table 1 relating to U.S. wire production have been derived from data on total U.S. consumption of iron or steel wire rods, virtually all of which are used to produce wire. The data therefore include wire intended for sale as well as that drawn by producer-fabricators in the course of making wire products. Table 1 overstates domestic wire production because no allowance has been made for normal scrap losses associated with the conversion of rod to wire. On the other hand, production data are understated to the extent that they do not include the tonnage of flat wire produced from plate, sheet, or strip. These two divergencies tend to balance each other; thus the data shown are believed to be reasonable estimates of annual output of the products covered by this summary.

Annual domestic production of iron or steel wire, as estimated, increased with only one interruption (in 1960) from about 4.5 million tons in 1958 to 5.8 million tons in 1964 and to 6.4 million tons in 1966. The various types of carbon steel wire have composed about 98 percent of total annual output.

Producers' shipments of drawn wire reported by the American Iron and Steel Institute probably account for virtually all shipments of drawn wire. Drawn-wire shipments, by types of iron or steel, in 1964-66 were as follows (in thousands of short tons):

	1964	1965	1966
Iron or carbon steel	2,467	2,776	2,724
Alloy iron or steel:			
Stainless	25	28	33
Other	26	38	40
Total	2,518	2,842	2,797

The difference between production and shipments represents for the most part wire fabricated by producers into wire products; it also reflects in-process scrap loss and changes in yearend inventories.

The volume of producers' shipments of wire in 1966 to manufacturers of wire products was distributed to major types of consumers as follows: 20 percent to producers of contractors' products; 18 percent to producers of industrial, commercial, and domestic machinery, equipment, and appliances; 8 percent to the automotive industry; 8 percent to producers of bolts, nuts, rivets, and screws; and 25 percent to producers of miscellaneous wire products for sale. Only about 5 percent went to warehouses and distributors.

As reported by the Bureau of Labor Statistics, the price of carbon steel wire 1/ increased by less than 1 percent between December 1958 ($10.575 per hundred pounds) and December 1966 ($10.678); however, during most of the period 1958-66 the price was somewhat lower than that prevailing at the end of 1958. The reported price of stainless steel wire 2/ increased during that period from $65.30 to $68.40 per hundred pounds, or by almost 5 percent.

U.S. exports

U.S. exports of iron or steel wire in recent years have been very small compared with production or imports. Annual exports declined from 27,734 tons in 1958 to 19,881 tons in 1961, but increased in each of the next 3 years and totaled 47,038 tons in 1964. Exports of iron or steel wire declined in 1965 and again in 1966, when they amounted to 28,166 tons.

1/ Drawn, low-carbon (0.10 percent) steel wire, 8 gage, cold heading quality, annealed in process, in coils, base quantity, f.o.b. mill to users.

2/ Drawn stainless steel (type 430) wire, 1/8 inch, in coils, base quantity, f.o.b. mill to users.

U.S. exports in recent years have gone principally to Canada, Mexico, Portugal, Pakistan, India, and Tunisia; these six countries provided markets for about 70 percent of total exports in the period 1964-66. The remaining exports went to about 75 other foreign markets, a few of which are shown in table 2. A considerable portion of U.S. exports in recent years have been financed by loans made through the Agency for International Development.

Plain carbon steel wire and galvanized carbon steel wire have together constituted the bulk of U.S. exports in recent years--87 percent during the period 1964-66 (table 3). Alloy steel wire (including stainless steel) and coated carbon steel wire, other than galvanized, have made up the remainder.

The major suppliers of U.S. imports--notably Japan and Belgium and Luxembourg--are also formidable competitors in foreign markets. Annual U.S. exports of iron or steel wire in recent years were substantially below those of a decade or more ago. On the other hand, average annual exports from Japan increased from 34,000 tons in 1952-54 to 388,000 tons in 1964-66; the corresponding export figures for the European Economic Community 1/ were 380,000 tons and 740,000 tons, respectively.

U.S. imports

Imports of iron or steel wire have increased substantially during the past several years (table 1). Stimulated by the labor walkout in domestic mills, imports increased from 163,000 tons in 1958 to 308,000 tons in 1959; they declined in 1960 and again in 1961, but increased in each year thereafter, reaching 450,000 tons in 1966.

1/ Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany.

Round wire, which has always made up the great preponderance of total imports of wire, constituted about 95 percent of the volume and about 90 percent of the value in 1965 and 1966, as indicated by the following tabulation:

Kind of wire	1965		1966	
	Quantity	Value	Quantity	Value
	Short tons	1,000 dollars	Short tons	1,000 dollars
Flat wire	15,911	7,169	15,771	7,441
Round wire	413,631	77,832	434,897	82,156
Other wire	3,640	567	4,987	924
Total	433,182	85,568	455,655	90,521

Detailed data on imports of flat wire, which have been available only since September 1963, are shown in table 4 for 1965 and 1966. During those years such imports were largely of carbon steel and over 0.01 inch but not over 0.05 inch in thickness (items 609.21 and 609.26). About 43 percent of the total volume of imports of round wire of carbon steel in 1965 and 40 percent in 1966 consisted of steels containing by weight over 0.25 percent carbon (table 5). The substantial share of the higher carbon steels in the rising volume of wire imports in recent years illustrates the increasing capability of foreign producers to supply steel wire not only for common applications but also for specialized uses. Imports of shape wire in 1965 and 1966 consisted almost entirely of wire of iron or carbon steel, not coated or plated (item 609.70, in table 6).

Total imports in 1965 and 1966 of the wire included in this summary, by type of iron or steel, were as follows:

Type	1965		1966	
	Quantity	Percent of total	Quantity	Percent of total
	Short tons		Short tons	
Iron or carbon steel:				
Uncoated	254,368	58.7	274,810	60.3
Coated	162,257	37.5	161,015	35.3
Subtotal	416,625	96.2	435,825	95.6
Alloy iron or steel	16,557	3.8	19,830	4.4
Total	433,182	100.0	455,655	100.0

The 1965 and 1966 imports of alloy steel wire contained alloys subject to the additional duties provided in items 607.01 to 607.04, as follows (in short tons):

	1965	1966
Dutiable alloy content of iron or steel wire:		
Chromium (item 607.01)------	1,109	1,746
Molybdenum (item 607.02)----	35	60
Tungsten (item 607.03)------	8	24
Vanadium (item 607.04)------	5	9

Table 7 shows imports of iron or steel wire, by principal sources, for 1966; the U.S. foreign suppliers have not changed significantly during the last decade. The unit values of individual classes of imported wire vary widely, depending on source. For example, imports from Sweden, long known for its quality steels, are substantially higher in value than similar imports from the other major sources. For specified kinds of wire imported in 1966, the average reported values per short ton of total imports 1/ and the range of the average unit values of the imports from the principal sources shown in table 7 were as follows:

	Average from all sources	Range
Flat wire:		
Carbon steel--------	$387	$202 (Japan) to $1,324 (Sweden).
Alloy steel---------	1,280	$90 (Belg. & Lux.) to $2,395 (Sweden).
Round wire:		
Low-carbon steel:		
Under 0.060 in. in diameter-----	207	$159 (Japan) to $917 (Sweden).
Other----------	123	$105 (France) to $574 (Sweden).
Other carbon steel:		
Under 0.060 in. in diameter-----	290	$151 (France) to $660 (Sweden).
Other----------	187	$160 (Japan) to $521 (Sweden).
Alloy steel---------	719	$503 (France) to $1,193 (Belg. & Lux.).
Other wire----------	185	$103 (Japan) to $1,312 (Sweden).
Average all wire--	199	$132 (France) to $907 (Sweden).

1/ Generally the market values in the foreign country; therefore they exclude U.S. import duties, freight, and transportation insurance.

Foreign production and trade

Production of wire has increased in virtually all steel-producing countries of the world in recent years. Data reported in the United Nations' publication Steel Statistics for Europe indicate that virtually all major steel-producing countries except the United States are substantial net exporters of iron or steel wire. The production and foreign trade of iron or steel wire in 1965, by selected countries, were as follows:

Country	Production 1/	Imports	Exports	Ratio of--Imports to production	Ratio of--Exports to production
	1,000 short tons	1,000 short tons	1,000 short tons	Percent	Percent
United States	6,346	433	32	6.8	0.5
U.S.S.R.	5,330	-	39	-	.7
European Economic Community:					
West Germany	3,162	80	210	2.4	6.6
France	1,308	45	121	3.4	9.3
Belgium-Luxembourg	896	11	319	1.2	39.0
Italy	727	17	23	2.3	3.2
Netherlands	196	65	29	33.2	14.8
Japan	2,535	1	433	2/	17.1
United Kingdom	1,909	6	139	.3	7.3

1/ Estimated; equivalent to apparent consumption of wire rods, which was computed from United Nations' data on production, imports, and exports.

2/ Less than 0.05 percent.

Table 1.--Wire of iron or steel: U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

(Quantity in thousands of short tons; value in thousands of dollars)

Year	Production 1/	Imports 2/	Exports	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1958	4,502	163	28	4,637	3.5
1959	5,052	308	21	5,339	5.8
1960	4,645	266	22	4,889	5.4
1961	4,847	233	20	5,060	4.6
1962	5,034	328	28	5,334	6.1
1963	5,381	355	47	5,689	6.2
1964	5,790	394	47	6,137	6.4
1965	6,346	433	32	6,747	6.4
1966	6,441	456	28	6,869	6.6
	Value				
1958	3/	24,650	9,304	3/	3/
1959	3/	48,182	7,502	3/	3/
1960	3/	45,910	7,623	3/	3/
1961	3/	40,626	7,504	3/	3/
1962	3/	56,896	9,948	3/	3/
1963	3/	62,396	14,720	3/	3/
1964	3/	71,948	19,918	3/	3/
1965	3/	85,568	15,200	3/	3/
1966	3/	90,521	11,733	3/	3/

1/ Derived from data on U.S. consumption of wire rods, both domestic and imported.

2/ Data for the years 1958-63 are partly estimated.

3/ Not available.

Source: Compiled from official statistics of the U.S. Department of Commerce, except as noted.

Table 2.--Wire of iron or steel: U.S. exports of domestic merchandise, by selected markets, 1964-66

Market	1964	1965	1966
	Quantity (short tons)		
Canada	7,955	7,525	6,671
Tunisia	50	1/	6,044
Mexico	3,020	5,085	4,092
Brazil	47	104	1,229
South Viet-Nam 2/	1,237	983	2,482
Venezuela	845	4,140	679
Colombia	64	63	461
Nigeria	22	1/	904
Chile	127	1,885	771
Honduras	1,066	241	399
Australia	584	654	185
Guatemala	222	139	388
Peru	133	126	236
United Kingdom	119	135	92
West Germany	172	172	163
All other	3/ 31,375	4/ 10,344	3,372
Total	47,038	31,596	28,166
	Value (1,000 dollars)		
Canada	4,130	4,466	4,130
Tunisia	15	1/	1,623
Mexico	920	1,646	1,497
Brazil	47	60	502
South Viet-Nam 2/	302	247	445
Venezuela	331	3,194	328
Colombia	46	52	242
Nigeria	5	1/	203
Chile	45	506	203
Honduras	233	88	159
Australia	400	392	152
Guatemala	56	31	128
Peru	59	64	112
United Kingdom	172	192	111
West Germany	146	172	106
All other	3/ 13,011	4/ 4,090	1,792
Total	19,918	15,200	11,733

1/ Nil or negligible.

2/ In the U.S. statistics trade with South Viet-Nam was separately reported beginning in 1966.

3/ Includes 9,451 tons, valued at 6,742 thousand dollars, to Portugal; 10,686 tons, valued at 2,431 thousand dollars, to Pakistan; and 6,917 tons, valued at 1,965 thousand dollars, to India.

4/ Includes 5,711 tons, valued at 1,762 thousand dollars, to India.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 3.--Wire of iron or steel: U.S. exports of domestic merchandise, by type of steel, 1964-66

Type of steel	1964	1965	1966
	Quantity (short tons)		
Carbon steel:			
Uncoated	21,571	14,866	18,605
Coated:			
Galvanized	20,290	12,511	4,669
Other	2,175	2,462	3,355
Alloy steel:			
Stainless	2,160	792	495
Other	842	965	1,042
Total	47,038	31,596	28,166
	Value (1,000 dollars)		
Carbon steel:			
Uncoated	7,390	5,402	6,140
Coated:			
Galvanized	8,365	5,526	1,714
Other	1,457	1,736	2,031
Alloy steel:			
Stainless	2,234	1,409	987
Other	472	1,127	861
Total	19,918	15,200	11,733

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Flat wire of iron or steel: U.S. imports for consumption, by tariff classification, 1965 and 1966

Abbreviated description and TSUS item number 1/	1965		1966	
	Quantity	Value	Quantity	Value
Iron or carbon steel:	Short tons	1,000 dollars	Short tons	1,000 dollars
Not coated or plated, in thickness--				
Not over 0.01 inch (609.20)	1,919	1,419	1,674	1,488
Over 0.01, not over 0.05 inch (609.21)	6,430	2,975	6,115	2,543
Over 0.05 inch (609.22)	529	199	743	236
Coated or plated, in thickness--				
Not over 0.01 inch (609.25)	59	33	233	62
Over 0.01, not over 0.05 inch (609.26)	6,162	1,351	5,483	1,178
Over 0.05 inch (609.27)	45	13	16	5
Alloy iron or steel:				
Not coated or plated, in thickness--				
Not over 0.01 inch (609.30):				
Stainless steel	271	732	318	845
Other	98	97	261	361
Over 0.01, not over 0.05 inch (609.31):				
Stainless steel	197	285	269	404
Other	48	39	211	194
Over 0.05 inch (609.32):				
Stainless steel	152	26	266	69
Other	1	2/	1	8
Coated or plated, in thickness over 0.01, not over 0.05 inch (609.36)	-	-	181	48
Total	15,911	7,169	15,771	7,441

1/ There were no imports under TSUS items 609.35 and 609.37.
2/ Less than $500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 5.--Round wire of iron or steel: U.S. imports for consumption, by tariff classification, 1965 and 1966

Abbreviated description and TSUS item number	1965		1966	
	Quantity	Value	Quantity	Value
Iron or carbon steel:				
Under 0.060 inch in diameter (609.40):	Short tons	1,000 dollars	Short tons	1,000 dollars
By weight not over 0.25 percent carbon:				
Not coated or plated	6,195	1,310	7,688	1,624
Coated or plated	17,058	3,330	18,755	3,852
By weight over 0.25 percent carbon:				
Not coated or plated	24,441	6,556	26,094	7,217
Coated or plated	24,695	7,559	22,406	6,837
Total	72,189	18,755	74,943	19,530
0.060 inch or more in diameter:				
By weight not over 0.25 percent carbon (609.41):				
Not coated or plated	127,210	16,061	137,849	16,704
Coated or plated	76,399	10,568	84,394	10,547
Total	203,609	26,629	222,243	27,251
By weight over 0.25 percent carbon (609.43):				
Not coated or plated	84,376	15,473	90,155	16,172
Coated or plated	37,813	7,223	29,523	6,236
Total	122,189	22,696	119,678	22,408
Alloy iron or steel (609.45):				
Under 0.060 inch in diameter:				
Stainless steel	1,792	1,983	2,866	3,720
High speed tool steel	5	12	12	10
Other	156	148	207	220
0.060 inch or more in diameter:				
Stainless steel	4,825	3,847	6,291	5,145
High speed tool steel	325	652	367	871
Other	8,541	3,110	8,290	3,001
Total	15,644	9,752	18,033	12,967
Grand total	413,631	77,832	434,897	82,156

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 6.--Wire of iron or steel other than flat and round: U.S. imports for consumption, by tariff classification, 1965 and 1966

Abbreviated description and TSUS item	1965		1966	
	Quantity	Value	Quantity	Value
	Short tons	1,000 dollars	Short tons	1,000 dollars
Iron or carbon steel:				
Not coated or plated (609.70)	3,368	464	4,492	710
Coated or plated (609.72)	126	53	205	59
Alloy iron or steel:				
Not coated or plated (609.75)	146	50	287	151
Coated or plated (609.76)	-	-	3	4
Total	3,640	567	4,987	924

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 7.--Wire of iron or steel: U.S. imports for consumption, by kinds and by principal sources, 1966

Country	Flat wire	Round wire	Other wire	Total
	Quantity (short tons)			
Japan	6,554	227,341	3,708	237,603
Belgium and Luxembourg	1,425	114,477	270	116,172
Sweden	2,094	8,538	68	10,700
West Germany	4,253	26,574	88	30,915
United Kingdom	576	20,079	738	21,393
France	570	26,349	-	26,919
All other	299	11,539	115	11,953
Total	15,771	434,897	4,987	455,655
	Value (1,000 dollars)			
Japan	1,345	37,869	383	39,597
Belgium and Luxembourg	379	19,919	88	20,386
Sweden	3,543	6,069	90	9,702
West Germany	1,761	6,500	34	8,295
United Kingdom	222	5,365	309	5,896
France	119	3,442	-	3,561
All other	81	2,992	20	3,093
Total	7,450	82,156	924	90,530

Source: Compiled from official statistics of the U.S. Department of Commerce.

Commodity	TSUS item
Plates, sheets, and strip of iron or steel:	
Not cut, not pressed, and not stamped to nonrectangular shape (except as provided in item 609.17):	
Plates and sheets:	
Not coated or plated with metal and not clad:	
Black plate	608.81, -.82
Other	608.84, -.85, -.87, -.88
Clad	608.90
Coated or plated with metal:	
Tin plate and tin coated sheets	608.92
Terne plate and terne coated sheets	608.93
Other	608.95, -.96
Strip	609.02, -.03, -.04, -.06, -.07, -.08
Cut, pressed, or stamped to nonrectangular shape (except as provided in item 609.17)	609.12, -.13, -.15
Electrolytically coated or plated with base metal other than tin, lead, or zinc	609.17

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

The United States has long been the world's largest producer and consumer of plates, sheets, and strip of iron and steel, and in 1965 it became also the world's largest importer of these products. Prior to 1963, U.S. exports far exceeded U.S. imports. In that year, imports equaled exports in terms of quantity, and by 1966, when imports accounted for about 7 percent of U.S. consumption, they were six times as large as exports.

Description and uses

Plates and sheets are hot-rolled, generally from slabs or sheet bars of iron or steel (see summary on items 608.15 to 608.18), and may be subsequently cold-rolled to obtain certain physical or surface characteristics. Plates are defined for tariff purposes in headnote 3(g) to part 2B of schedule 6 as "flat rolled products . . . in coils or cut to length, 0.1875 inch or more in thickness and, if not cold-rolled, over 8 inches in width, or, if cold rolled, over 12 inches in width." Currently, plates range in width from 8 inches (or 12, depending on method of rolling) to 206 inches. Plates are used principally

for boilers, tanks, steel railway cars, ships, pipe, safes, bridges, and other structural purposes.

Sheets are defined in headnote 3(g) mentioned above as "flat rolled products . . . in coils or cut to length, under 0.1875 inch in thickness and over 12 inches in width." They range up to 72 inches or more in width. In modern mills, sheet can be rolled and coiled at the rate of 3,200 feet or more per minute. Before being cold-rolled, sheets are cleaned (or pickled) to remove the scale, and the finishing reductions are made while the sheets are cold. This process results in improved mechanical properties, more nearly uniform thickness, and a surface finish far superior to that of hot-rolled sheets. Most sheets are made of carbon steel; some are made of alloy steel containing nickel, copper, silicon, chromium, or other metal which imparts special characteristics, such as corrosion resistance. The automotive industry is the largest single consumer of sheets, which are used primarily for bodies of motor vehicles. Sheets are also used in the manufacture of pipe, water heaters, refrigerators, metal furniture, and fabricated structural sections.

For tariff purposes "black plate," "tin plate," and "terne plate" are sheets; see headnote 3(g). Black plate is "cold rolled steel sheets, not coated, under 0.0142 inch in thickness"; used principally in the manufacture of tin plate, it is rarely of alloy steel. Tin plate and tin coated sheets are steel sheets coated with tin, and terne plate and terne coated sheets, production of which is small, are steel sheets coated with terne metal, a lead-tin alloy. The tin coating may be applied by hot dipping (immersion in molten tin) or by electrolysis. Tin plate is used principally in the manufacture of containers, chiefly food cans; it is also used in the production of bottle closures, toys, kitchen utensils, and dairy equipment. Plates and sheets may also be galvanized or coated or plated with other metals.

Clad plates and sheets generally consist of steel with a thin outer layer of nickel, nickel alloy, copper, monel stainless steel, or other base metal or alloy permanently bonded thereto by mechanical or thermal means; see headnote 3(d) to part 2 of schedule 6. The cladding generally represents 10 to 20 percent of the total thickness and may be on one or both sides of the steel plate or sheet. Clad steel offers a variety of unique characteristics, some of which are corrosion resistance, abrasion resistance, high strength, and electrical conductivity. Clad steel has important uses in refinery applications, in shipbuilding, and in the chemical industry.

Strip is "a flat-rolled product" produced from billets, slabs, or sheets, "in coils or cut to length, under 0.1875 inch in thickness, . . . and not over 12 inches in width"; see headnote 3(h) to part 2B of schedule 6. "If cold rolled," the steel strip is "over 0.5 inch but not over 12 inches in width." Strip is generally hot-rolled from billets or slabs in mills of the continuous type and can be finished in

a wide variety of qualities and surfaces. Like sheet, strip may be rolled cold to improve its properties and its surface. Much strip is produced by slitting sheet. Strip is adapted to the manufacture of a multitude of articles by mass-production methods in the automotive and other industries.

The plates, sheets, and strip covered by the TSUS items in this summary may be corrugated or crimped; they may also be subjected to treatments to improve the properties or appearance of the metals or to protect them against rusting, corrosion, or other deterioration. Items 609.12 to 609.15 provide for plates, sheets, and strip cut, pressed, or stamped to non-rectangular shape. These products that have been advanced in condition or dedicated to a particular use, however, are classifiable elsewhere. For example, it is the practice of the U.S. Bureau of Customs to classify under item 657.20 the following:

(1) Painted and baked standard cold-rolled carbon sheets, corrugated along the width and dedicated for use as parts of swimming and wading pools by having (a) a hem along the length made by folding the edge over itself and (b) holes punched and dimpled along the short edges (T.D. 56410 (6)); and

(2) Electrogalvanized steel strip, 3 inches wide and 0.13 inch thick, in rolls, which has been completely covered (apparently by gluing) with a thin sheet of paper to form a surface for writing or printing (T.D. 56490 (60)).

The plates, sheets, and strip provided for in item 609.17 are electrically coated or plated principally with chromium, nickel, or copper. Such so-called preplated steel is used to fabricate a wide variety of articles which do not require further finishing to impart a decorative effect.

In this summary, all quantities are expressed in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Plates, sheets, and strip of iron or steel:	
	Not cut, not pressed, and not stamped to nonrectangular shape: 1/	
	Plates and sheets:	
	Not coated or plated with metal and not clad:	
	Black plate:	
608.81	Corrugated or crimped	10% ad val.
608.82	Other	8% ad val.
	Other:	
	Not pickled and not cold rolled:	
608.84	Other than alloy iron or steel	8% ad val.
608.85	Alloy iron or steel	12% ad val. 2/
	Pickled or cold rolled:	
608.87	Other than alloy iron or steel	0.1¢ per lb. + 8% ad val.
608.88	Alloy iron or steel	0.1¢ per lb. + 12% ad val. 2/
608.90	Clad	24% ad val.
	Coated or plated with metal:	
608.92	Tin plate and tin coated sheets	0.8¢ per lb.
608.93	Terne plate and terne coated sheets	1¢ per lb.
	Other:	
608.95	Other than alloy iron or steel	0.1¢ per lb. + 8% ad val.
608.96	Alloy iron or steel	0.1¢ per lb. + 12% ad val. 2/
	Strip:	
	Other than alloy iron or steel, in thickness--	
609.02	Not over 0.01 inch	6% ad val.
609.03	Over 0.01 but not over 0.05 inch	8.5% ad val.
609.04	Over 0.05 inch	9.5% ad val.
	Alloy iron or steel, in thickness--	
609.06	Not over 0.01 inch	10% ad val. 2/
609.07	Over 0.01 but not over 0.05 inch	12.5% ad val. 2/
609.08	Over 0.05 inch	13.5% ad val. 2/
	Cut, pressed, or stamped to nonrectangular shape: 1/	
	Other than alloy steel, value per pound--	
609.12	Not over 8 cents	8% ad val.
609.13	Over 8 cents	9.5% ad val.
609.15	Alloy iron or steel	13% ad val. 2/
609.17	Electrolytically coated or plated with base metal other than tin, lead, or zinc	19% ad val.

1/ Except as provided in item 609.17.
2/ Plus additional duties as provided under items 607.01 to 607.04 (see appendix A).

Before August 31, 1963, the effective date of the TSUS, the tariff treatment of the articles considered here was provided for under many complex and sometimes confusing provisions of the Tariff Act of 1930. The current tariff rates, which were based on, or derived from, the rates previously applicable to the imports of such articles, reflect concessions granted by the United States in the General Agreement on Tariffs and Trade (GATT).

The 10-percent rate for corrugated or crimped black plate (item 608.81), in effect since January 1, 1948, is the same as the rate formerly provided under paragraph 308 for such products valued at more than 3 cents per pound. The 24-percent rate for clad plates and sheets (item 608.90), in effect since July 1, 1963, is the same as the rate formerly provided under paragraph 309. The rates for the plates and sheets in items 608.92 and 608.93 are the same as the rates formerly provided under paragraph 310; the 0.8-cent-per-pound rate for tin plate and tin coated sheets has been in effect since June 30, 1958, whereas the 1-cent-per-pound rate for terne plate and terne coated sheets is the rate initially provided in the Tariff Act of 1930. The rate for terne plate and terne coated sheets has been bound in a GATT concession since January 1, 1948. The 19-percent rate for the articles in 609.17 is based on the rate applicable to certain nickel-plated steel strip under paragraph 397 in accordance with a court decision dated December 12, 1962 (C.A.D. 810). With respect to the articles in the other 16 TSUS items considered here, for which the current rates became effective on August 31, 1963, the simplification of the tariff structure did not result in significant rate changes.

On the 1966 imports of plates, sheets, and strip dutiable at the specific or compound rates shown on the preceding page, the ad valorem equivalent of the duty was as follows:

TSUS item	Percent
608.87	10.0
608.88	12.3
608.92	9.1
608.93	9.3
608.95	9.5
608.96	12.3

About 52 percent of the 1966 imports considered here entered at 8 percent ad valorem (under item 608.84), and nearly 43 percent, at the rate of 0.1 cent per pound plus 8 percent ad valorem (under either item 608.87 or item 608.95), which rate was equivalent to about 10 percent ad valorem (see foregoing tabulation). About 1.5 percent of the 1966 imports were entered under the item numbers for alloy iron or steel; for a discussion of the additional duties under items 607.01 to 607.04, see the general statement on the provisions of subpart 2B of schedule 6.

U.S. consumption

Annual U.S. consumption of plates, sheets, and strip of iron or steel increased from an estimated 40.5 million tons in 1958 to 68.2 million in 1966, or by about 70 percent. The ratio of imports to consumption, in terms of quantity, rose from less than 1 percent in 1961 to 7 percent in 1966 (table 1). The increase in consumption of these products reflects increasing demand by the traditional consumers--principally producers of transportation equipment, heavy machinery, and industrial equipment--and also the development of new products.

Sheets (including those in coils for black plate and tin plate) constitute about three-fourths of the hot-rolled products considered here, and plates, nearly all of the remainder. The automotive industry is the leading consumer of sheets and strip, in 1966 taking about 42 percent of the domestic shipments of hot- and cold-rolled sheets and strip. Steel service centers and distributors, which cater primarily to the needs of small producers of a wide variety of consumer products, take about 15 percent of domestic shipments of sheets and strip and probably a substantial part of the imports.

Producers of containers and packaging materials, especially for food and beverages, consume nearly all of the U.S. supply of "tin plate" (tin coated sheets), and the construction industry takes about 25 percent of the domestic shipments of plates. Manufacturers of machinery and industrial equipment are also large consumers of plates, accounting for about 20 percent of the total domestic shipments, while the railroad industry consumes about 14 percent.

U.S. producers

Many steel companies in the United States produce the flat-rolled products here considered, which account for about two-thirds of the total shipments by the steel industry. The facilities currently available for producing plates, sheets, and strip include several new high-speed rolling mills. Facilities for producing sheets are owned by 30 companies operating in 11 States, and those for producing plates, by 27 companies operating in 14 States. Annual domestic capacity for producing hot-rolled sheets exceeds 40 million tons; that for making plates is about 12 million tons. The 3 largest concerns together own almost half of the total domestic capacity for the production of hot-rolled plates and sheets. More than two-thirds of the total producing capacity is in Pennsylvania, Ohio, Indiana, and Michigan. Other important producing States are Maryland, New York, and Illinois. Hot-rolled plates and sheets are the principal products of many concerns and the only products of some.

The companies that produce plates and sheets, including all the major integrated concerns, also produce black plate, hot-dipped tin and terne plate, and electrolytic tin plate. Total annual capacity for the production of these products, which exceeds 8 million tons, is situated in eight States, of which Indiana, Pennsylvania, Maryland, and West Virginia, in the order named, are the most important. The two largest companies account for more than 50 percent of total domestic capacity.

Four domestic concerns produce clad plates, one of them for its own use. One producer accounts for well over half of the total domestic production. Only one domestic concern produces clad sheets. For none of the domestic producers are clad plates and sheets important products. Pennsylvania is the principal producing State.

Thirty-one concerns situated in 13 States have total capacity to produce about 3 million tons of hot-rolled strip annually. Although 1 of the largest integrated steel companies owns about 20 percent of total domestic capacity, 3 companies together--none of the top 10 of the steel industry--account for more than 45 percent of total domestic capacity. Eighty-five percent of the capacity is concentrated in Pennsylvania, Ohio, and Illinois.

There are 43 companies--including 25 producers of hot-rolled strip--that have facilities in 14 States to produce about 4 million tons of cold-rolled strip annually. No company or group of companies dominates the production of cold-rolled strip, and no concern owns as much as 15 percent of the total capacity to produce it. Ohio and Pennsylvania are the principal producing States. Although production of steel strip, both hot- and cold-rolled, is of minor importance to the larger integrated steel companies, it represents a substantial part of the business of some of the small companies.

U.S. production

During the period 1958-66, annual U.S. production of hot-rolled plates, sheets, and strip, which accounted for 35 to 40 percent of the total world output of such products, increased almost without interruption from 41.8 million tons, valued at about $5.5 billion, in 1958 to 64.2 million tons, valued at about $8.6 billion, in 1966. The following tabulation, compiled from data of the American Iron and Steel

Institute, shows U.S. production of hot-rolled plates, sheets, and strip in 1958-66 (in millions of short tons):

Year	Plates	Sheets		Strip	Skelp 1/	Total
		In coils for black plate and tin plate	Other			
1958	6.6	7.0	23.1	1.8	3.3	41.8
1959	7.0	6.4	26.9	1.9	3.7	45.9
1960	7.5	8.0	29.8	1.5	3.2	50.0
1961	6.9	7.9	28.4	1.5	3.3	48.0
1962	7.1	6.9	30.4	1.5	3.1	49.0
1963	8.2	7.2	33.8	1.5	3.0	53.7
1964	9.9	8.0	38.0	1.7	3.5	61.1
1965	11.4	7.8	39.2	1.8	3.6	63.8
1966	11.0	7.7	40.0	1.7	3.8	64.2

1/ The term "skelp," which is not used in the TSUS, means plate, sheet, or strip that is to be used for making seamed tubular products. More than half of the U.S. output of such tubular products is made from sheets, as defined in the TSUS.

The production of hot-rolled sheets other than coils for black plate and tin plate accounts for about 60 percent of the total U.S. production of all hot-rolled products covered here. The trend of production of sheets is closely correlated with that of automobiles. The rise in the production of sheets since 1958 also reflects the increasing use of galvanized sheet, particularly for farm installations and equipment and for the production of automotive products. In 1966, U.S. production of galvanized sheets amounted to 5.0 million tons, or about 45 percent of world production.

Since 1958, annual output of plates also has increased significantly, but that of strip, black plate, and skelp has fluctuated within a narrow range. The production of plates in 1966--11.0 million tons--was 67 percent larger than the production in 1958.

Throughout the 1958-66 period almost 95 percent of the production of plates, sheets, and strip was of carbon steel, and the remaining 5 percent was of alloy steel, of which about one-fifth to two-fifths was stainless. Virtually all skelp and black plate were made of carbon steel. In 1966, 19 percent of the plates, nearly 5 percent of the sheets, and slightly more than 5 percent of the strip were made of alloy steel.

Domestic production of tin plate (made from black plate) has exhibited no definite upward or downward trend in recent years, fluctuating from 4.6 million tons in 1959 to 5.9 million tons in 1966.

Production of tin plate by the hot-dip process, however, has declined somewhat, while that by the electrolytic process, which requires less tin per unit of surface coated, has generally increased.

Although official statistics on U.S. production of clad plates and sheets are not available, trade sources indicate that the annual domestic output of these products in recent years has fluctuated between 20,000 and 25,000 tons.

Significant tonnages of the annual output of hot-rolled sheets and strip are cold-rolled to improve their surfaces. During 1958-66, production of cold-rolled sheets ranged between 11.9 million tons (in 1958) and 21.1 million tons (in 1966), and production of cold-rolled strip (including that produced from cold-rolled sheets) fluctuated between 1.5 million tons (in 1958) and 2.3 million tons (in 1964). These data, as well as those shown in the tabulation on the preceding page, do not include an unknown amount of strip produced from sheet at steel service centers.

Prior to World War II, flat-rolled products were generally cut to certain lengths before shipment to fabricators. In recent years fabricators have recognized the economies of feeding continuous lengths of sheet or strip into their presses and forming machinery, so that today most sheets and strip are sold in coils weighing as much as 20 tons, or even more. Sales of flat-rolled products in coil form also reduce producers' handling costs and simplify their inventory procedures.

According to the U.S. Bureau of Labor Statistics, average annual wholesale prices of most of the steel products considered here fluctuated within a narrow range during 1958-65. Galvanized sheet, which has scored the largest gains in production since 1958, has also had the largest price increase--8 percent. Prices of hot-rolled, uncoated carbon plates and sheets, which account for the bulk of U.S. production, have increased by about 4 percent since 1958, whereas prices of tin plate declined by about 2 percent and prices of black plate, the raw material for tin plate, increased by about 2 percent. During the same 8-year period, average annual prices of hot-rolled carbon strip declined by 2 percent, and prices of cold-rolled carbon strip increased by 1 percent. Wholesale prices of stainless steel, however, dropped sharply during 1958-65: average annual prices of cold-rolled stainless sheets declined by 29 percent and those of cold-rolled stainless strip, by 9 percent. The downward trend of the prices of stainless steel reflected competition from imported stainless steel and some reduction in production costs by the use of new machinery and the development of more efficient methods of production.

U.S. exports

Annual U.S. exports of plates, sheets, and strip of iron or steel during 1958-66 averaged about 1.3 million tons, valued at $266 million. Unlike production, which increased almost without interruption, exports fluctuated widely in the period 1958-66--between 793,000 tons in 1966 and 2.2 million tons in 1960 (table 1). The annual fluctuations in these exports reflect in large measure the annual changes in the exports under U.S. Government programs for assistance to foreign countries. For example, expenditures in the United States by the Agency for International Development for the export of plates, sheets, skelp, tin plate, and terne and black plate amounted to $92.0 million in 1965 and to $43.8 million in 1966.

U.S. exports of the products considered here have been limited in recent years by various forms of tariff and nontariff barriers in several foreign markets. The construction of modern rolling mills in many countries and the ever-increasing competition from other major steel-producing countries in these products as well as in more sophisticated products will continue to be factors affecting U.S. exports of plates, sheets, and strip in the immediate future.

In recent years, exports of hot-rolled carbon sheets, corrugated galvanized sheets, and hot-rolled stainless steel sheets have trended upward, while exports of cold-rolled carbon sheets and of electrolytic tin plates have generally declined. Annual exports of the other products covered here fluctuated widely, or were not significant. In 1966, tin plate and other coated or plated sheets or plate accounted for about 55 percent of the total exports considered here, as indicated by the data shown in the following tabulation, by type of product:

	1,000 short tons	Percent of total
Sheets and plates:		
Not coated or plated:		
Carbon steel	196	25
Alloy steel:		
Stainless	69	9
Other	43	5
Coated or plated:		
Tin plate	298	38
Galvanized	86	11
Terne plate	17	2
Other	35	4
Hoop and strip:		
Carbon steel	32	4
Alloy steel:		
Stainless	10	1
Other	7	1
Total	793	100

In the 3-year period 1964-66, Canada and Pakistan were by far the leading markets for U.S. exports of plates, sheets, and strip, in terms of both quantity and value (table 2). In 1966, however, South Viet-Nam ranked second in terms of quantity and third in terms of value.

U.S. imports

Since 1961, annual U.S. imports of plates, sheets, and strip, in terms of quantity, have increased more than twentyfold, and since 1964 have exceeded exports (table 1). In 1966, when imports amounted to 4.8 million tons, valued at $517.2 million, they were about six times as large as exports in terms of quantity and slightly more than 2-1/2 times in terms of value. A very small portion of the imports generally enter duty free. In 1966 the duty-free imports included nearly 6,000 tons, valued at $1.2 million, for manufacture and export and about 2,600 tons, valued at $0.9 million, for U.S. Government use.1/ A small portion of the dutiable imports considered here were advanced in condition in the United States, then exported, and virtually all the duty on the imported merchandise (or substituted domestic merchandise of the same kind and quality) was refunded under the provisions of section 1313 of title 19 of the U.S. Code. In 1965, duties were recovered on 147,000 tons of the products included in this summary and used in the production of motor vehicles and parts. In that year duties were also recovered on about 9,000 tons of tin plate that was exported in the form of tin cans. Information is not available on the date of either the importation of the merchandise on which the duty was recovered or the exportation of the finished product. Comparable data on the payment of drawback in other years have not been compiled.

Imports, like exports, consist largely of hot- and cold-rolled sheets of carbon (nonalloyed) steel. More than 90 percent of the imports considered here are accounted for by three items--608.84 (nonalloyed plates and sheets, hot rolled, not pickled), 608.87 (nonalloyed plates and sheets, pickled or cold rolled), and 608.95 (nonalloyed coated or plated plates and sheets), virtually all of which were galvanized sheets (table 3). In 1966, imports entered under item 608.84 amounted to 2.5 million tons; those under item 608.87, 1.5 million; and those under item 608.95, 0.5 million.

Alloy steel constitutes a smaller share of the imports of plates, sheets, and strip than it does of either U.S. production or exports of these products. Of the total volume of imports considered here, alloy steel accounted for 1 to 2 percent of the annual imports in 1964-66.

1/ See special provisions of schedule 8 of the TSUS.

Total annual imports of these products of alloy steel in 1964-66 and their alloy content subject to the additional duties provided in items 607.01 to 607.04 were as follows (in short tons):

	1964	1965	1966
Plates, sheets, and strip:			
Alloy steel, total imports	34,452	51,271	69,898
Dutiable alloy content:			
Chromium (item 607.01)	5,487	7,737	10,455
Molybdenum (item 607.02)	57	66	110
Tungsten (item 607.03)	6	12	23
Vanadium (item 607.04)	2	4	9

In 1964-66 Japan supplied slightly more than half of the imports considered here (table 4). West Germany, the United Kingdom, Canada, France, Sweden, Mexico, and Belgium and Luxembourg were also important suppliers. While the volume of imports has increased significantly in recent years, the average unit value, computed from the values reported in the official U.S. statistics (generally the market values in the foreign country, hence excluding U.S. import duties, freight, and transportation insurance), has declined. The decline in average unit value from $167 per ton in 1961 to $108 per ton in 1966 reflects changes in prices and in the composition of the imports. The average unit value of the 1966 imports varied by country from $95 per ton (from West Germany) to more than $800 per ton (from Sweden). Sweden has long been the principal source of high-quality alloy strip.

Imports are competitive nationwide with domestically produced plates, sheets, and strip, particularly in highly industrialized coastal areas adjacent to the ports of entry. Michigan, Los Angeles, Chicago, and New York, in the order named, were the principal customs districts through which these imports entered the United States in 1965 (table 5). The imported products are usually ordered to U.S. specifications and standards based on chemical composition or mechanical properties, or both, and therefore are generally of the same quality as corresponding domestic products. In recent years the importers have had a price advantage over the domestic producers, which has enabled them to gain an increasing share of the U.S. market. On the other hand, U.S. producers have a geographic advantage which permits them to give consumers quicker, better, and more reliable service. U.S. producers can also grant better credit terms than the importers.

Foreign production and trade

The United States is by far the world's largest producer, consumer, and importer of plates, sheets, and strip of iron or steel. The U.S.S.R. is probably the second largest producer; in 1965 it was

followed by Japan, West Germany, the United Kingdom, France, Italy, and Belgium-Luxembourg (table 6). Since 1961, production of the articles considered here has increased significantly in each of these countries. In 1965 Japan was the world's leading exporter, followed by West Germany, Belgium-Luxembourg, and France. In terms of the percentage of production exported, Belgium and Luxembourg together ranked first by exporting nearly four-fifths of their output in 1965; Japan exported somewhat more than a fifth of its output in that year. In 1965 the United States ranked seventh as an exporter and was by far the leading importer.

Table 1.--Plates, sheets, and strip of iron or steel: U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

Year	Production	Imports		Exports		Apparent consumption	Ratio of imports to consumption
		Quantity	Value	Quantity	Value		
	1,000 short tons	1,000 short tons	1,000 dollars	1,000 short tons	1,000 dollars	1,000 short tons	Percent
1958	41,829	1/	1/	1,583	282,228	1/	1/
1959	45,853	1/	1/	1,006	199,966	1/	1/
1960	49,975	1/	1/	2,164	416,442	1/	1/
1961	48,025	2/ 196	2/ 32,745	1,193	237,473	47,028	0.4
1962	48,956	2/ 546	2/ 77,624	1,143	238,164	48,359	1.1
1963	53,657	2/ 1,174	2/154,968	1,179	250,364	53,652	2.2
1964	61,087	1,721	211,632	1,587	316,090	61,221	2.8
1965	63,805	4,432	489,930	1,052	250,100	67,185	6.6
1966	64,221	4,786	517,250	793	200,683	68,214	7.0

1/ Not available.
2/ Partly estimated.

Source: Production as reported by the American Iron and Steel Institute; data on value of production are not available. Exports compiled from official statistics of the U.S. Department of Commerce; imports for 1964-66 from official statistics of the U.S. Department of Commerce, and other import data partly estimated on the basis of data reported by the Department of Commerce.

Note.--It is estimated that the 64.2 million tons of plates, sheets, and strip produced in 1966 was valued in excess of $8.6 billion.

Table 2.--Plates, sheets, and strip of iron or steel: U.S. exports of domestic merchandise, by principal markets, 1964-66

Market	1964	1965	1966
	Quantity (short tons)		
Canada	253,230	232,013	164,678
Pakistan	344,091	212,402	79,795
South Viet-Nam 1/	42,116	72,347	108,167
Italy	117,066	34,106	56,022
Mexico	22,801	26,446	28,941
Belgium and Luxembourg	18,596	17,562	17,040
United Kingdom	151,187	11,595	12,431
India	154,418	123,412	31,620
Argentina	48,842	31,933	20,424
Colombia	15,374	9,360	17,814
Turkey	84,210	37,079	19,768
West Germany	32,593	15,121	7,217
Venezuela	23,137	12,992	10,681
Sweden	15,940	8,581	8,636
Israel	12,604	7,330	2,678
All other	251,225	197,933	207,456
Total	1,587,430	1,050,212	793,368
	Value (1,000 dollars)		
Canada	71,658	83,176	73,222
Pakistan	60,846	37,173	14,237
South Viet-Nam 1/	5,584	9,492	13,970
Italy	16,422	5,897	9,385
Mexico	8,208	8,616	8,944
Belgium and Luxembourg	9,019	10,190	8,582
United Kingdom	20,231	5,958	6,687
India	27,496	22,559	5,451
Argentina	9,369	6,066	4,278
Colombia	2,720	1,758	3,490
Turkey	11,377	5,524	2,982
West Germany	10,918	5,352	2,817
Venezuela	4,473	2,930	2,320
Sweden	3,523	2,675	2,284
Israel	1,579	1,382	611
All other	52,667	41,352	41,423
Total	316,090	250,100	200,683

1/ In the U.S. statistics trade with South Viet-Nam was separately reported beginning in 1966.

Source: Compiled from official statistics of the U.S. Department of Commerce.

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Table 3.--Plates, sheets, and strip of iron or steel: U.S. imports for consumption, by TSUS items, 1964-66

TSUS item	Quantity			Value		
	1964	1965	1966	1964	1965	1966
	Short tons	Short tons	Short tons	1,000 dollars	1,000 dollars	1,000 dollars
608.81	158	492	3	16	46	1/
608.82	6,755	22,554	9,324	520	1,834	851
608.84	928,552	2,262,104	2,498,964	84,061	199,093	210,991
608.85	2,872	3,062	4,530	1,739	1,657	2,114
608.87	436,998	1,524,863	1,510,677	47,218	162,064	150,841
608.88	26,178	40,342	52,477	18,401	26,243	33,691
608.90	5	13	341	3	10	68
608.92	80,693	121,941	125,031	13,754	20,808	22,086
608.93	-	-	49	-	-	11
608.95	190,021	397,193	505,276	28,201	58,304	69,350
608.96	22	111	284	13	50	179
609.02	1,775	1,891	2,681	1,545	1,824	2,626
609.03	16,627	17,783	20,191	5,251	5,834	6,681
609.04	20,565	25,969	25,398	2,348	2,991	2,912
609.06	1,760	1,440	2,408	4,627	3,806	5,103
609.07	2,690	4,731	6,808	2,044	3,069	4,654
609.08	704	893	2,147	442	607	1,260
609.12	2,145	3,019	7,503	200	296	632
609.13	1,675	2,145	10,061	680	430	1,948
609.15	226	692	1,244	263	600	897
609.17	541	690	759	307	364	355
Total	1,720,951	4,431,928	4,786,156	211,632	489,930	517,250

1/ Less than $500.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Plates, sheets, and strip of iron or steel: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Japan	905,542	2,274,872	2,656,464
West Germany	263,992	583,093	662,186
United Kingdom	72,732	439,020	494,838
Canada	262,768	314,744	320,000
France	48,984	321,322	208,163
Sweden	5,732	6,619	14,445
Mexico	74,420	102,489	100,350
Belgium and Luxembourg	54,356	261,453	90,778
All other	32,425	128,315	238,932
Total	1,720,951	4,431,927	4,786,156
	Value (1,000 dollars)		
Japan	111,310	250,591	286,436
West Germany	25,211	57,958	63,177
United Kingdom	10,803	47,029	50,225
Canada	31,933	41,714	39,271
France	6,934	33,319	23,224
Sweden	8,124	8,652	12,221
Mexico	8,054	11,646	10,908
Belgium and Luxembourg	5,772	24,399	9,538
All other	3,491	14,622	22,250
Total	211,632	489,930	517,250

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 5.--Plates, sheets, and strip of iron or steel: U.S. imports for consumption, by principal customs districts, 1964 and 1965

(In thousands of dollars)

Customs district	1964	1965
Michigan	34,747	103,320
Los Angeles	30,179	55,497
Chicago	13,458	47,448
Philadelphia	10,453	42,003
New York	25,339	38,035
Galveston	13,225	26,901
New Orleans	8,308	23,289
San Francisco	7,159	12,635
Oregon	9,290	12,429
Laredo	7,772	11,554
Washington	6,894	9,621
Hawaii	5,820	6,791
All other	38,988	100,407
Total	211,632	489,930

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 6.--Plates, sheets, and strip of iron or steel: Production, imports, and exports, by selected countries, 1961-65

(In thousands of short tons 1/)

Item	1961	1962	1963	1964	1965
United States:					
Production	48,025	48,956	53,657	61,087	63,806
Imports	227	594	1,207	1,717	4,426
Exports	1,187	1,125	1,161	1,720	1,046
U.S.S.R.:					
Production	18,503	20,479	22,529	24,157	2/
Imports	268	181	87	42	39
Exports	1,203	1,510	1,637	1,981	2,094
Japan:					
Production	12,773	12,858	15,189	20,076	20,387
Imports	149	40	32	18	15
Exports	1,351	2,009	2,576	3,320	4,473
West Germany:					
Production	10,543	11,266	10,840	13,268	13,210
Imports	1,682	2,162	2,199	2,560	2,868
Exports	2,569	2,708	2,698	3,101	3,822
United Kingdom:					
Production	8,846	8,929	10,251	11,888	11,952
Imports	169	230	438	650	355
Exports	1,651	1,798	2,189	2,235	2,104
France:					
Production	7,029	6,800	7,135	7,913	7,813
Imports	1,152	1,272	1,448	1,710	1,655
Exports	2,491	2,322	2,361	2,789	2,921
Belgium and Luxembourg:					
Production	3,365	3,708	4,011	4,659	4,734
Imports	209	227	249	299	305
Exports	2,368	2,519	2,850	3,276	3,718
Italy:					
Production	3,165	3,322	3,564	3,846	4,842
Imports	866	1,432	1,776	1,082	773
Exports	293	326	342	532	780
Netherlands:					
Production	1,408	1,543	1,735	1,861	1,987
Imports	672	622	638	798	762
Exports	694	773	1,000	941	1,031
Austria:					
Production	1,563	1,528	1,562	1,681	1,601
Imports	40	49	40	42	50
Exports	611	628	636	607	559
Sweden:					
Production	811	956	1,107	1,311	1,426
Imports	690	669	678	790	882
Exports	190	217	262	364	382

1/ Converted from metric tons. 2/ Not available.

Source: United Nations, Quarterly Bulletin of Steel Statistics for Europe, 1965 and 1966.

Commodity	TSUS item
Angles, shapes, and sections of iron or steel	609.80, -.82, -.84, -.86, -.88, -.90
Sheet piling	609.96, -.98

Note.--For the statutory description, see the Tariff Schedules of the United States (pertinent sections thereof are reproduced in appendix A to this volume). For discussion of the provisions of subpart 2B of schedule 6, see the general statement beginning on p. 23.

U.S. trade position

The United States is the free world's leading producer, consumer, and importer of angles, shapes, sections, and sheet piling of iron or steel and ranks sixth in exports. U.S. imports, which increased in quantity about sixfold from 1958 to 1966 and exceeded exports in every year after 1958, supplied 15 percent of U.S. consumption in 1966.

Description and uses

Angles, shapes, and sections.--For tariff purposes, the term "angles, shapes, and sections of iron or steel" relates to products that do not conform completely to TSUS specifications for blooms, billets, slabs, sheet bars, bars, wire rods, plates, sheets, strip, wire, rails, joint bars, or tie plates and do not include any tubular products; see headnote 3 to part 2B of schedule 6.

The angles, shapes, and sections provided for in items 609.80 to 609.90 may be hot rolled, forged, extruded, or drawn, or cold formed or cold finished, whether or not drilled, punched, or otherwise advanced; only very small quantities are forged, extruded, or drawn. The angles, shapes, and sections covered here are of uniform cross section throughout their length. In the trade the terms "shapes" and "sections" are used synonymously; "light shapes" is used to refer to configurations such as angles, channels, tees, and zees that have all cross-sectional dimensions of less than 3 inches, whereas "heavy shapes" is used for articles with cross-sectional dimensions of 3 inches or more. The term "structural shape" generally denotes a rolled, flanged section having at least one cross-sectional dimension of 3 inches or more, and therefore relates to all shapes and sections from a 1- by 3-inch angle to a 36-inch or larger "I" beam of the type used in bridge construction. Structural shapes are described as wide-flange sections which are rolled on special mills, and standard sections, which can be rolled on conventional structural mills. The

term "regular sections" refers to shapes and sizes that are in constant demand and therefore rolled on a regular basis and stocked, whereas "special sections" refers to shapes and sizes that require specially designed rolls that are used only occasionally.

Structural shapes are produced in several hundred different sizes and shapes to meet the particular requirements of their many uses. The sizes of structural shapes are generally designated by weight per unit of length rather than per unit of thickness. Beams and heavy channels are identified by depth of the section and weight per unit of length; light channels are designated simply by depth and thickness; and angles, by the length of the legs and weight per linear measure, or by thickness. Physical requirements, rather than chemical limits, of structural shapes are commonly specified.

Light (or bar) shapes are generally hot-rolled from billets and sometimes from used rails or axles that are first heated to a uniform rolling temperature. Bar shapes can be rolled on the same rolling mills used for bars; it is necessary to close the mill for only a short time to change the rolls and certain accessory equipment. Heavy shapes (including structural shapes) are rolled directly from ingots or blooms or from reheated billets, depending on the size of the finished section. Most of these products are further fabricated before being used. Both light and heavy shapes are generally made of carbon steel (i.e., steel of the type provided for in items 609.80, 609.84, and 609.88). Since 1960, however, structural shapes of alloy steel have become increasingly important, owing to the rising production of high-strength, low-alloy steels that enable consumers to use less steel to get at least the same strength as from the use of carbon steel.

Although angles, shapes, and sections are used principally by the construction industry, they have other important uses, particularly for framing in ships, submarines, automobiles, agricultural implements, furniture, vaults, and other articles.

Sheet piling.--Sheet piling is a rolled steel specialty product with longitudinal joints which, when the piling is driven into the ground, interlock to form a continuous wall that is resistant to earth and water pressures. It is used in trenches and other excavations and in such types of construction as docks, wharves, piers, cofferdams, seawalls, and building foundations, where the purpose is to produce a tight steel enclosure against excessive leakage and pressure. Sheet piling is usually made from steel with a carbon content slightly higher than that of structural-grade steel, so that it can better withstand severe driving. Copper is frequently added to the steel to retard corrosion, and the piling is often coated with acid-free tar, paint, or other material for the same purpose.

In this summary, all quantities are given in terms of short tons (2,000 pounds).

U.S. tariff treatment

The current column 1 rates of duty applicable to imports (see general headnote 3 in appendix A) are as follows:

TSUS item	Commodity	Rate of duty
	Angles, shapes, and sections:	
	Hot rolled; or cold formed and weighing over 0.29 pound per linear foot:	
	Not drilled, not punched, and not otherwise advanced:	
609.80	Other than alloy iron or steel	0.1¢ lb.
609.82	Alloy iron or steel	0.1¢ lb. + 4% ad val. 1/
	Drilled, punched, or otherwise advanced:	
609.84	Other than alloy iron or steel	7.5% ad val.
609.86	Alloy iron or steel	11.5% ad val. 1/
	Cold formed and weighing not over 0.29 pound per linear foot:	
609.88	Other than alloy iron or steel	8.5% ad val.
609.90	Alloy iron or steel	12.5% ad val. 1/
	Sheet piling:	
609.96	Other than alloy iron or steel	0.1¢ per lb.
609.98	Alloy iron or steel	0.1¢ per lb. + 4% ad val. 1/

1/ Plus additional duties as provided under items 607.01 to 607.04 (see appendix A).

These tariff provisions, derived principally from the provisions of paragraphs 304, 305, and 312 of the former tariff schedules, reflect concessions granted by the United States in the General Agreement on Tariffs and Trade (GATT). During 1964-66, about 94 percent of the imports considered here were dutiable under item 609.80 at 0.1 cent per pound, the GATT rate, which became applicable on June 6, 1951, to the beams, girders, joists, angles, and other structural shapes provided for in paragraph 312. Only 0.1 percent of the 1964-66 imports considered here were of alloy steel and subject to the additional duties on content of chromium, molybdenum, tungsten, or vanadium, as provided for under items 607.01 to 607.04.

The ad valorem equivalents of the specific and compound rates shown above (exclusive of the additional duties under items 607.01 to 607.04), based on imports in 1966, are as follows:

TSUS item	Percent
609.80	2.2
609.82	4.4
609.96	2.0

There have been no imports of alloyed sheet piling (item 609.98) in recent years.

On September 17, 1964, the Secretary of the Treasury issued a "finding of dumping" on imports from Canada of carbon steel bars (items 608.45 to 608.50, included in a separate summary), bars-shapes under 3 inches, and structural shapes 3 inches and over (T.D. 56264, 29 F.R. 13319). Since then special dumping duties, in addition to the regular duties, have been payable on such imports from a particular exporter in Canada. As required by the Antidumping Act, the Secretary's "finding of dumping" had been preceded by a determination of the Tariff Commission that a domestic industry was being injured. 1/

U.S. consumption

Annual U.S. consumption of the structural products considered here increased from about 5.4 million tons in 1958 to 9.6 million tons in 1966 (table 1). This substantial rise in consumption occurred despite the increasing use of high-strength, low-alloy steels that save 25 percent or more in the weight of structural shapes but maintain required load-carrying capacity.

Consumption of angles, shapes, sections, and sheet piling is largely dependent on, and follows the trend of, nonresidential construction. The construction industry is the leading consumer, taking about 55 percent of producers' domestic shipments. About 20 percent of producers' shipments go to steel service centers and distributors; about 8 percent, to producers of rail transportation equipment; and about 4 percent, to producers of machinery and industrial equipment.

U.S. producers

Fifteen companies have facilities in about 15 States to produce

1/ U.S. Tariff Commission, Carbon Steel Bars and Shapes From Canada: Determination of Injury, TC Publication 135, 1964 (processed).

about 9 million tons of heavy structural shapes annually. Two of these companies account for about three-fourths of the total capacity. Thirty-one companies, including most of the concerns that produce heavy structural shapes, have facilities in about 25 States to produce about 1.5 million tons of light shapes annually. No single concern possesses as much as one-fifth of the total capacity for the production of light shapes.

Of the six companies producing sheet piling, two account for the great bulk of U.S. capacity. Sheet piling, however, represents but a small part of the total business of each of the domestic producers.

In recent years domestic producers have continually upgraded structural steel and yet have introduced economies through the utilization of new fabricating techniques and construction designs. The use of high-strength, low-alloy steels has also significantly reduced fabricating, handling, and construction costs. The various shapes, dimensions, grades, and types of products supplied by domestic producers are more numerous than those supplied by importers.

U.S. production

Domestic production of angles, shapes, sections, and sheet piling of iron or steel amounted to 5.5 million tons in each of the years 1958-59, rose to 6.4 million tons in 1960, declined to 5.7 million tons in 1962, and increased by 10 to 17 percent a year in 1963-65, amounting to 8.3 million tons in 1965. The 1966 output was 8.2 million tons, of which about 7 percent was made of alloy iron or steel. Annual production, by types of products, in 1958-66 was as follows (in thousands of tons):

Year	Heavy shapes	Light shapes 1/	Sheet piling	Total 2/
1958	4,227	992	321	5,541
1959	4,206	1,052	254	5,512
1960	5,085	1,040	286	6,411
1961	4,446	1,071	303	5,820
1962	4,376	902	378	5,656
1963	4,960	895	417	6,272
1964	5,774	1,035	535	7,344
1965	6,225	1,416	668	8,310
1966	6,263	1,424	549	8,236

1/ About 8 to 10 percent of the annual production of light shapes is rerolled from old rails and axles.

2/ Because of rounding, figures may not add to the totals shown.

U.S. exports

Annual U.S. exports of angles, shapes, sections, and sheet piling of iron or steel fluctuated widely during 1958-66, from 382,000 tons in 1958 to 131,000 tons in 1966 (table 1). Beginning in 1959, exports were exceeded by imports and--after 1960--by a widening margin. Exports of light shapes, which are not separately reported in the official statistics and hence not included in table 1, are believed to be relatively small, probably less than 10,000 tons a year.

In 1966 Canada was the principal market, accounting for almost three-fourths of total exports (table 2). Because of increased competition from the European and Japanese steel industries, the U.S. share of world exports of structural shapes has decreased in recent years. Competition in world markets is primarily a question of price, which of course, is affected by tariff levels.

Except in 1960 and 1965, the average unit value of U.S. exports increased each year of the period 1958-66, rising from $114 per ton to $171. In 1966 about 9 percent of the exports consisted of articles of alloy iron or steel, and the average unit value varied by market from $127 per ton (Peru) to $219 per ton (Surinam). Exports to Canada averaged $160 per ton, and those to Mexico, $211 per ton.

U.S. imports

The quantity and value of U.S. imports have been rising rapidly in recent years. Imports increased from about 215,000 tons, valued at $22.4 million, in 1958 to almost 1.5 million tons, valued at $144.9 million, in 1965 (table 1). In 1966, imports amounted to about 1.5 million tons, valued at $140.2 million. The ratio of imports to consumption (based on quantity) increased from 4 percent in 1958 to 16 percent in 1965; it was 15 percent in 1966. For light shapes, which in recent years have accounted for about a sixth of the domestic output of the products considered here, the ratio of imports to consumption probably exceeded 25 percent in 1964 and 30 percent in both 1965 and 1966.

During 1964-66, angles, shapes, and sections of iron or steel, weighing over 0.29 pound per linear foot, not drilled, not punched, not otherwise advanced, and not of alloy iron or steel (item 609.80) accounted for about 92 percent of U.S. imports of the articles considered here (table 3). In the same period, articles of alloy iron or steel (items 609.82, 609.86, 609.90, and 609.98) accounted for about 0.1 percent of the total.

While the annual imports considered here have increased significantly in tonnage since 1958, the reported value 1/ has fluctuated between an average of $94 per ton (in 1963) and $114 per ton (in 1960) and averaged $96 per ton in 1966. The average unit values in 1966 ranged from $90 per ton for the articles of carbon steel of the types entered under item 609.80 to $617 per ton for the drilled, punched, or otherwise advanced articles of alloy steel entered under item 609.86 (table 3).

Belgium and Luxembourg, which have traditionally been the principal source of the imports here considered, accounted for about 41 percent of the total in 1965 and 1966. Japan, West Germany, France, Italy, and the United Kingdom are also important sources of imports (table 4). The percentages of the total quantity of U.S. imports of angles, shapes, sections, and piling supplied by these five countries in 1966 were as follows: Japan, 23 percent; West Germany, 10 percent; France, 9 percent; the United Kingdom, 9 percent; and Italy, 4 percent. The average unit value of imports entered under item 609.80 in 1966 varied by country of origin from $85 per ton (for those from West Germany) to $122 per ton (for those from Canada); it was $87 per ton for the imports from France, and $90 per ton for the imports from Belgium-Luxembourg and Japan.

Although imports have penetrated the U.S. market nationwide, they are particularly competitive with domestically produced structural shapes and piling in certain highly industrialized coastal areas near the ports of entry. Galveston, New York, and Michigan, in the order named, are the principal customs districts through which these imports enter the United States (table 5). In 1965 the Galveston district accounted for about 15 percent of the quantity and value of the imports. The following customs districts (named in order of magnitude of quantity entered) also accounted for a significant volume: Florida, Los Angeles, Chicago, South Carolina, Mobile, and Oregon.

Foreign production and trade

The U.S.S.R. is probably the world's largest producer of the products covered by this summary, principally because of its predominance in the manufacture of heavy sections as indicated by the data in table 6. The United States, however, ranks first among the nations of the free world as producer, consumer, and importer. The heavy shapes or sections (including sheet piling) in table 6 account for at least four-fifths of the tonnage of U.S. production of all the products covered herein. Other large producing countries, named in the order

1/ Generally the market value in the foreign country; therefore it excludes U.S. import duties, freight, and transportation insurance.

of magnitude of quantities produced in 1965, are the United Kingdom, West Germany, Japan, Belgium and Luxembourg, France, and Italy. Since 1961 all of these countries have scored gains in the production of heavy shapes. Production of such products increased by 92 percent in Japan during 1961-65, and by smaller percentages in the European countries, ranging from about 8 percent (in West Germany) to 38 percent (in Belgium and Luxembourg).

After the United States, West Germany and France are the principal importers of heavy shapes; the United Kingdom and Japan import only small quantities. Belgium and Luxembourg together are the free world's largest exporter of heavy shapes, exporting almost three-fourths of their annual production. West Germany, France, Japan, and the United Kingdom each export larger quantities of heavy shapes than the United States.

Table 1.--Angles, shapes, sections, and sheet piling of iron or steel: U.S. production, imports for consumption, exports of domestic merchandise, and apparent consumption, 1958-66

(Quantity in thousands of short tons; value in thousands of dollars)

Year	Production	Imports 1/	Exports 2/	Apparent consumption	Ratio (percent) of imports to consumption
	Quantity				
1958	5,541	215	382	5,374	4
1959	5,512	665	240	5,937	11
1960	6,411	450	345	6,515	7
1961	5,820	435	223	6,033	7
1962	5,656	550	159	6,047	9
1963	6,272	950	162	7,060	13
1964	7,344	1,063	250	8,157	13
1965	8,310	1,485	241	9,553	16
1966	8,236	1,460	131	9,565	15
	Value				
1958	3/	22,440	43,430	3/	3/
1959	3/	64,865	31,850	3/	3/
1960	3/	51,200	41,181	3/	3/
1961	3/	45,500	30,826	3/	3/
1962	3/	56,590	23,047	3/	3/
1963	3/	89,000	24,249	3/	3/
1964	3/	101,000	38,973	3/	3/
1965	3/	144,851	37,183	3/	3/
1966	3/	140,159	22,338	3/	3/

1/ Data for 1958-63 were partly estimated from official U.S. statistics.

2/ Data do not include bar-size shapes; exports of bar-size shapes probably amount to 10 thousand tons annually.

3/ Not available.

Source: Production, from American Iron and Steel Institute; imports and exports, compiled from official statistics of the U.S. Department of Commerce, except as noted.

Table 2.--Angles, shapes, sections, and sheet piling of iron or steel: U.S. exports of domestic merchandise, by principal markets, 1964-66

Market	1964	1965	1966
	Quantity (short tons)		
Canada	168,013	184,290	95,649
Mexico	5,924	6,032	5,189
South Viet-Nam 1/	4,215	11,081	3,983
Peru	3,364	2,928	3,935
Philippine Republic	14,647	6,804	3,128
Venezuela	2,812	1,283	2,328
Tunisia	8,510	303	1,649
Surinam	1,651	884	361
Pakistan	11,471	526	245
Portugal	2,596	3,336	-
All other	26,595	23,753	14,521
Total	249,798	241,220	130,988
	Value (1,000 dollars)		
Canada	22,949	25,886	15,343
Mexico	951	966	1,094
South Viet-Nam 1/	832	1,641	738
Peru	519	474	501
Philippine Republic	3,471	1,838	453
Venezuela	441	187	327
Tunisia	1,652	52	237
Surinam	418	184	79
Pakistan	2,038	182	37
Portugal	477	854	-
All other	5,225	4,919	3,529
Total	38,973	37,183	22,338

1/ In the U.S. statistics trade with South Viet-Nam was separately reported beginning in 1966.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 3.--Angles, shapes, sections, and sheet piling of iron or steel: U.S. imports for consumption, by TSUS item, 1964-66

TSUS item 1/	1964	1965	1966
	Quantity (short tons)		
609.80	1,009,101	1,405,853	1,354,437
609.82	235	197	4,644
609.84	34,879	41,389	59,513
609.86	135	738	363
609.88	57	12	13
609.90	-	1	-
609.96	18,457	36,348	40,596
Total	1,062,864	1,484,538	1,459,565
	Value (1,000 dollars)		
609.80	91,748	132,558	122,042
609.82	70	71	2,201
609.84	7,123	8,230	11,610
609.86	71	238	224
609.88	13	11	3
609.90	-	1	-
609.96	1,975	3,742	4,079
Total	101,000	144,851	140,159
	Unit value (per short ton)		
609.80	$91	$94	$90
609.82	298	358	474
609.84	204	199	195
609.86	529	323	617
609.88	226	943	272
609.90	-	888	-
609.96	107	103	100
Average	95	98	96

1/ There were no imports under TSUS item 609.98.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 4.--Angles, shapes, sections, and sheet piling of iron or steel: U.S. imports for consumption, by principal sources, 1964-66

Country	1964	1965	1966
	Quantity (short tons)		
Belgium and Luxembourg	557,109	606,095	594,906
Japan	178,968	356,928	335,557
United Kingdom	65,823	86,986	125,458
West Germany	107,619	158,235	143,053
France	100,418	128,702	131,929
Italy	25,342	122,301	60,379
Canada	21,211	13,621	29,307
All other	6,374	11,670	38,976
Total	1,062,864	1,484,538	1,459,565
	Value (1,000 dollars)		
Belgium and Luxembourg	50,333	58,037	53,799
Japan	16,714	33,545	31,130
United Kingdom	7,136	9,114	13,122
West Germany	9,581	14,851	12,505
France	8,787	11,965	11,570
Italy	4,642	14,199	9,856
Canada	3,202	1,957	5,256
All other	605	1,183	2,921
Total	101,000	144,851	140,159

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table 5.--Angles, shapes, sections, and sheet piling of iron or steel: U.S. imports for consumption, by principal customs districts, 1964 and 1965

Customs district	Quantity		Value	
	1964	1965	1964	1965
	Short tons	Short tons	1,000 dollars	1,000 dollars
Galveston	178,227	238,057	15,729	21,962
New York	141,445	170,962	13,870	16,509
Michigan	127,457	166,221	11,159	15,569
Florida	83,772	127,570	7,590	11,972
Los Angeles	74,694	110,648	7,475	11,122
Chicago	67,439	90,552	6,522	10,037
South Carolina	57,196	76,243	5,059	7,240
Mobile	30,743	56,019	3,361	6,468
Oregon	29,585	53,440	3,541	5,708
All other	272,306	394,826	26,694	38,264
Total	1,062,864	1,484,538	101,000	144,851

Source: Compiled from official statistics of the U.S. Department of Commerce.