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# IRON AND STEEL INDUSTRY AND TRADE OF INDIA



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## FOREWORD

Although iron has been produced in India since time immemorial, the Indian iron and steel industry of today is in no wise the outgrowth or development of this early production. While the present four major iron and/or steel companies were organized and commenced operations at various dates over the past 50 years, it was not until just prior to the World War that the development of the industry made any appreciable progress. At the present time the local industry, it is estimated, supplies 40 percent of domestic requirements—the balance being drawn from a variety of sources, of which the United Kingdom is the chief, total consumption being in the neighborhood of 2,500,000 tons per annum. Per capita consumption, however, is very low, an approximate figure of only 14 pounds being frequently stated, but with India's growing industrialization this may be expected to increase in coming years.

Except for pig iron, India is not a factor in the world export trade in iron and steel. Pig iron exports amounted to 568,000 tons in 1929-30, a record performance up to and since that time—the 1931-32 exports being only 350,000 tons. The United States annually purchases a considerable proportion of this exportation—in 1931-32 this country took 14.6 percent of the total exported.

The Iron and Steel Division of the Bureau of Foreign and Domestic Commerce keeps in close touch with developments in the iron and steel trade and industry of all countries, including India, and invites inquiries from interested parties relative to these industries.

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JUNE 1933

# IRON AND STEEL INDUSTRY AND TRADE OF INDIA

By George C. Howard, American Trade Commissioner, Calcutta

The production of iron is one of India's oldest industries, and even today there are hundreds of small foundries producing iron by old native methods and supplying certain local requirements. Early attempts to introduce European methods of iron production proved abortive, and it was not until 1881 that the pioneer plant, of what is now the Bengal Iron & Steel Co., was (after its failure) taken over temporarily by the Government and put on an operating basis, thereby establishing the first unit of India's expanding iron and steel industry of today.

The modern Indian industry is truly indigenous. Capital, raw materials, all but highly skilled labor, and both present and potential markets are Indian. The Government of India recognizes the great possibilities for the future expansion of the industry and its value to the country and have accorded it a full measure of assistance, so that in a rapidly developing industrial India the future of the iron and steel industry should be bright.

India's present per capita consumption of iron and steel is very low, the approximate figure of 14 pounds (0.007 short ton) per annum being cited as the lowest of any country except China. Despite this, India, with an enormous population of 350,000,000, 42,000 miles of railroads, growing manufacturing industries which have already put it sixth in the rank of modern industrial countries, large engineering projects, and the spread of modernized building methods, consumes nearly 2,500,000 tons of iron and steel a year, and annually exports large quantities of pig iron—these exports in 1929-30 reaching the very considerable total of 568,000 tons.

## RAW MATERIALS

The modern Indian iron and steel industry occupies a fortunate position—both economically and geographically—with respect to its supplies of raw materials. Iron ore sufficient to last the industry for an indefinite period, coking coal in quantities to satisfy anticipated requirements for 100 years, and numerous large deposits of limestone are all to be had within a relatively restricted area. It is estimated that within this area is centered 98 to 99 percent of the pig-iron production and virtually all of the steel making facilities of the country—the result being a raw material assembly cost which is extremely low as compared to that of other less fortunate industries. Fortunately, too, these raw materials and this productive equipment is well located with respect to several of the principal consuming markets of India and the plants have been erected at points giving ready access to rail-transportation facilities. The one unit of the industry—the Mysore Iron & Steel Works at Bhadravati, Mysore—not enjoying this most favored situation lacks only coking coal, and in place thereof uses

charcoal made from the forests of that State, adequate iron ore and flux being at hand to satisfy the present moderate requirements of this company.

### IRON ORE

Deposits of high-grade ore exist in many parts of India, exceptionally accessible locations being in Bihar and Orissa. It is here that the center of the iron and steel industry is situated and these deposits are known as the "Iron Belt." Present workings are from 120 to 200 miles west of Calcutta and from 20 to 50 miles south the main line of the Bengal Nagpur Railway between Calcutta and Nagpur. Practically all supplies are at present being taken from hillside workings and no expensive deep mining operations are likely to be necessary for many years.

According to the Geological Survey of India, the deposits in the Singhbhum District, Keonjhar State, Bonai State, and Mayurbhanj State are remarkable for enormous quantities of extremely high grade ore, and will prove to be among the largest and richest in the world.

Practically the whole of the ore is hematite and no quantity of magnetite has been located in the ore-bodies. The hematite is rather variable in character and the varieties are grouped as follows: (1) Massive hematite, (2) laminated hematite, (3) micaceous hematite, (4) laterite hematite, and (5) hematite breccia.

The Kolhan hematites usually contain about 64 percent of iron, with phosphorus ranging from 0.03 to 0.08 percent or, in some cases, as high as 0.15 percent. The sulphur content is usually below 0.03 percent. Titanium in very small quantities is also said to be found occasionally in the ore. Samples from the better parts of the ore deposits contain as much as 68 or 69 percent iron. Numerous other analyses of these ores also show high iron content, a relatively low percentage of sulphur and titanium, and variable phosphorus content. Manganese in any quantity seems to occur only in the lateritic variety of the ore.

The major part of the iron ore seems to be divided between the Singhbhum District, Keonjhar State, and Bonai State. The minimum quantities of ore averaging not less than 60 percent of iron estimated to date are shown in the following statement:

	<i>Tons</i>
Singhbhum District.....	1, 074, 000, 000
Keonjhar State.....	806, 000, 000
Bonai State.....	656, 000, 000
Bonai State or Keonjhar State (doubtful).....	280, 000, 000
Mayurbhanj State.....	16, 000, 000
<b>Total.....</b>	<b>2, 832, 000, 000</b>

The estimate concerning ore beds in Mayurbhanj State has not yet been verified, but recent discoveries seem to indicate that the present estimate may be considerably increased. However, prospecting work and mining operations, carried out by the various companies, indicate that the solid hematite often gives place to an unconsolidated micaceous powdery variety at depths between 80 and 100 feet below the surface.

Over the last 7 years the iron-ore production of India has been as shown in the following table:

**PRODUCTION AND VALUE OF IRON ORE MINED IN INDIA DURING THE YEARS  
1924 TO 1930**

District	Quantity	Value	District	Quantity	Value
<b>1924</b>			<b>1927—Continued</b>		
Bihar and Orissa:	<i>Tons</i>	<i>Rupees</i>	Burma.....	<i>Tons</i>	<i>Rupees</i>
Singhbhum.....	305, 238	-----	Central Provinces.....	61, 062	244, 248
Sambalpur.....	654	-----	Mysore.....	918	3, 846
Mayurbhanj.....	996, 920	-----	Other Provinces and States..	48, 465	128, 695
Total.....	1, 302, 812	3, 236, 497	Total.....	1, 846, 735	5, 101, 861
Burma.....	59, 014	238, 056	<b>1928</b>		
Central Provinces.....	68, 361	373, 702	Bihar and Orissa:		
Mysore.....	14, 958	39, 324	Singhbhum.....	1, 131, 746	-----
Other Provinces and States..	168	1, 001	Sambalpur.....	21	-----
Total.....	1, 445, 313	3, 886, 580	Mayurbhanj.....	683, 493	-----
<b>1925</b>			Keonjhar.....	141, 361	-----
Bihar and Orissa:			Total.....	1, 956, 821	5, 172, 547
Singhbhum.....	477, 580	-----	Burma.....	74, 813	299, 352
Sambalpur.....	703	-----	Central Provinces.....	934	3, 972
Mayurbhanj.....	957, 275	-----	Mysore.....	23, 624	58, 841
Total.....	1, 435, 558	4, 113, 585	Total.....	2, 056, 992	5, 534, 607
Burma.....	51, 617	206, 468	<b>1929</b>		
Central Provinces.....	1, 037	4, 182	Bihar and Orissa:		
Mysore.....	56, 218	154, 000	Singhbhum.....	1, 390, 245	-----
Other Provinces and States..	148	866	Sambalpur.....	21	-----
Total.....	1, 544, 878	4, 479, 101	Mayurbhanj.....	759, 875	-----
<b>1926</b>			Keonjhar.....	187, 203	-----
Bihar and Orissa:			Total.....	2, 337, 344	6, 191, 309
Singhbhum.....	552, 079	-----	Burma.....	146, 140	184, 560
Sambalpur.....	569	-----	Central Provinces.....	715	2, 145
Mayurbhanj.....	1, 041, 920	-----	Mysore.....	44, 356	113, 222
Total.....	1, 594, 577	4, 414, 639	Total.....	2, 428, 556	6, 491, 236
Burma.....	48, 069	192, 356	<b>1930</b>		
Central Provinces.....	972	3, 987	Bihar and Orissa:		
Mysore.....	15, 427	73, 278	Singhbhum.....	1, 099, 435	-----
Other Provinces and States..	230	1, 406	Sambalpur.....	6	-----
Total.....	1, 659, 295	4, 685, 666	Mayurbhanj.....	659, 392	-----
<b>1927</b>			Keonjhar.....	24, 909	-----
Bihar and Orissa:			Total.....	1, 783, 742	4, 629, 600
Singhbhum.....	1, 007, 037	-----	Burma.....	133, 458	133, 832
Sambalpur.....	561	-----	Central Provinces.....	925	2, 775
Mayurbhanj.....	692, 137	-----	Mysore.....	31, 500	106, 320
Keonjhar.....	36, 325	-----	Total.....	1, 849, 625	4, 872, 527
Total.....	1, 736, 060	4, 723, 662			

<sup>1</sup> Estimated.

<sup>2</sup> Excludes 1,909 tons of hematite quartzite.

**COAL**

It has been stated that, according to present knowledge of deposits, India has insufficient good coking coal to smelt the principal ore deposits by present methods, but there is probably sufficient within a reasonable distance of the ore to last for 100 years at the present and probable near-future rate of consumption.

The principal source of coking coal is at present the Jharia coal field in Bihar and Orissa, which field has an estimated reserve of 2,300,000,000 long tons of coal suitable for making metallurgical coke. The most recently published estimates of total coal reserves show 2,632,000,000 long tons of coking coal, after allowing one third for losses out of a grand total of 36,311,000,000 tons of coal of all kinds

and usable grades. The details of all presently known resources are shown in the following table:

RESERVES OF COAL OF ALL KINDS IN INDIA (MILLIONS OF GROSS TONS)

Coal fields	Total, all kinds of coal	Total coals of coking quality <sup>1</sup>	All coals other than coking coal	Coal fields	Total, all kinds of coal	Total coals of coking quality <sup>1</sup>	All coals other than coking coal
Giridih.....	60	40	20	Talchir.....	44		44
Raniganj.....	22,000	408	21,592	Wardha and Godavari.....	400		400
Jharia.....	20,500	2,300	18,200	Satpura region.....	150	( <sup>2</sup> )	150
Bokaro Ramgarh.....	1,000	600	400	Assam.....	600	600	( <sup>3</sup> )
Karanpura, South.....	75	( <sup>4</sup> )	8,975	Rajmahal area.....	200	( <sup>2</sup> )	200
Karanpura, North.....	8,900					Other fields.....	100
Aurunga.....	20			Total.....	54,467	3,948	50,519
Hutar.....	9	( <sup>4</sup> )	9	Allowing one third for losses.....	36,311	2,632	33,679
Daltonganj.....	9		9				
Korea, Rewa.....	200		200				
Sirguja, Korba, Sambalpur.....	200	( <sup>4</sup> )					

<sup>1</sup> Coal which might be suitable for the manufacture of metallurgical coke.

<sup>2</sup> At least this amount.

<sup>3</sup> Not fully tested.

<sup>4</sup> Said to be some.

Much of this coal is high in ash and would hardly be considered first-class coal in America. Mixtures of coals from various seams are used, and the following analysis is that of such a mixture from Jharia seams used by one of the iron works.

Percent of—	Coal	Coke (produced from foregoing coal)	Percent of—	Coal	Coke (produced from foregoing coal)
Moisture.....	1.98	2.58	Ash.....	11.58	19.37
Volatile matter.....	25.74	1.32	Sulphur.....	.50	
Fixed carbon.....	62.20	76.45	Phosphorus.....	.10	

The ash of the coke above described on analysis revealed silica to constitute 9.40 percent of the total coke; alumina, 5.59 percent; ferric oxide, 2.44 percent; lime, 0.89 percent; magnesia, 0.12 percent; phosphoric oxide, 0.41 percent; and sulphur 0.52 percent—or a total of 19.37 percent.

The cost of coking coal to the furnace quite naturally depends on the distance from the mines to consuming centers, but, generally speaking, an average of 3 rupees per ton for coking coal, f.o.r. colliery, may be taken as the price obtaining in March 1933.

At present a large quantity of coal suitable for the production of metallurgic coke is being used by steam-raising plants. Owing to the comparative scarcity of good coking coal a number of efforts have been made to stop this practice, but no workable solution has as yet been arrived at and the practice continues.

CHARCOAL

The Mysore Iron Works operate the only charcoal blast furnace in the country, and their charcoal supplies are obtained from Mysore State forests.

### FLUXES

The most important flux is limestone, of which India has innumerable large deposits of first quality within reasonable distances of existing iron and steel plants. The average analysis of limestone from sources drawn upon is as follows:

	<i>Percent</i>
Calcium carbonate.....	95.80
Silica.....	2.70
Ferric oxide and alumina.....	.80
Magnesium carbonate.....	2.25

Indian production of limestone from 1924 to 1928 averaged over 3,000,000 tons per annum. This quantity includes an average annual output of 165,000 tons of dolomite in Bihar and Orissa for use as flux and furnace linings.

### MANGANESE ORE

India is one of the principal sources of the world's supply of manganese ore, and exports over the 5 fiscal years ending with 1930-31 averaged 645,000 tons per annum. The Indian iron and steel industry uses manganese in extremely small quantities, when compared with India's output and resources in this mineral. Deposits in Bihar and Orissa are conveniently situated for the iron and steel industry, which consumes not more than 20,000 to 25,000 tons per year. An average analysis of two types of high-grade manganese ore from Bihar and Orissa fields is shown in the following statement:

	<i>Percent</i>
Manganese.....	47.66
Iron.....	2.90
Silica.....	4.63
Phosphorus.....	.34
Moisture.....	.03
Manganese plus iron.....	50.56

### SCRAP, FIRE BRICK, AND REFRACTORY BRICK

India imports an average of 3,000 tons of iron and/or steel scrap for remanufacture, the bulk of which comes from the United Kingdom and Ceylon.

Deposits of quartzite and fire clay occur near the coal fields, and from these materials good quality fire brick and silica brick is made, and quartzite lining for Bessemer converters secured. Magnesite brick for furnace linings is mainly imported at present, owing to the inaccessibility of magnesite deposits and lack of a proper brick-making plant, but it is probable that the latter condition will be remedied in the near future.

### LOCATION OF THE INDUSTRY

The location of the bulk of the Indian iron and steel industry in the immediate vicinity of the Bihar and Orissa ore beds is dictated by the exceptionally fortunate situation existing there as regards supplies of raw materials, which are not only available in ample quantity to carry the industry for an indefinite time, but the coal and ore fields now being worked are located so close together that raw material transportation costs are extremely small as compared with those in

the iron and steel industries of other countries. The three large plants, which together constitute nearly 99 percent of the pig-iron production capacity of the country—the plant of the Tata Iron & Steel Co., Ltd., at Jamshedpur, the Indian Iron & Steel Co.'s plant at Burnpore (near Asansol), and the works of the Bengal Iron Co., Ltd., at Kulti, Bengal—together with the ore fields and the coal mines from which their materials are obtained are all situated within a small area, and are well within 200 miles of Calcutta on the main line railroads. The railroads serving them likewise serve the great Gangetic plain which constitutes one of the principal iron and steel markets in the country.

As previously stated, the industry is based entirely on materials produced within the country, including iron ore, coking and gas coal, limestone, manganese ore, and dolomite, plus practically all of the necessary refractory materials. In Mysore, where there is no available coal, the Mysore Iron Works use charcoal from the forests of the State.

#### DEVELOPMENT OF THE INDUSTRY

With the building of railways in India and the growing use of iron and steel in construction, imports of these materials increased heavily, and attempts to start an Indian iron and steel industry were almost immediately made. Four such attempts between 1830 and 1874 came to naught, but in the latter year the present Bengal Iron & Steel Co. was started as the Barakar Iron Works, and in 1911, the now largest unit of the industry—the Tata Iron & Steel Co.—began on a moderate scale what is now one of the large steel works in the British Empire, and the center around which revolves the Government of India's tariff and other protective activity.

It cannot be said that the present steel industry in India has gone through a true "development" stage, for the reason that the processes by which steel is at present manufactured are the same as those in vogue at the time of the inception of the industry on a really modern basis just before the World War. No significance attaches to the production accomplished with the primitive methods employed for centuries before within the country.

Improvements in equipment and efficiency have, of course, been continuously made and today the smaller blast furnaces find it impossible to operate in competition with the large modern furnaces installed within the past few years. In general, handling methods, both for raw materials and manufactured products, compare favorably with those in vogue in the modern plants in America and elsewhere, and although a great deal more manual labor is employed to accomplish a given task than in other countries this situation is being rapidly bettered. For example, the incidence of labor in the cost per ton of finished steel in 1925 was 46 rupees 4 annas or 37 percent, and in 1932 31 rupees or 29 percent. In 1924 the total works' cost of a ton of tinsplate, made from purchased tinsplate bar, was 458 rupees 9 annas of which 90 rupees or 19 percent was labor as compared with 22.5 percent in Britain during the same year. In 1926 this figure had been reduced to 312 rupees 7 annas, of which 45 rupees 1 anna, or 14 percent, was labor. Later figures in this connection are not available, but the incidence of labor in the total cost has been further appreciably reduced in the intervening years. The approximate labor cost per

ton of pig iron in 1920 was 2 rupees 5 annas which had been reduced by 1932 to 1 rupee. Similar figures for ingots were 6 rupees 5 annas and 2 rupees 5 annas. This improvement in labor cost is due to the installation of more modern machinery, the "Indianization" of the plants with the subsequent releasing of many highly paid foreigners, and also the greater efficiency of the Indian workmen as they become familiar with steel-works practice.

At the end of 1932 the four leading producing units (with a combined rated pig-iron capacity of 1,750,000 tons) were the Tata Iron & Steel Co., Ltd., the Indian Iron & Steel Co., Ltd., the Mysore Iron Works, and the Bengal Iron Co., Ltd. Of these works, the Tata Iron & Steel Co., Ltd., is the only one producing steel on a large scale—neither the Indian Iron & Steel Co., Ltd., nor the Bengal Iron Co., Ltd., produce steel, although the Bengal Iron Co., Ltd., did so 25 years ago. The Mysore Iron Works currently produce alloy and special steels on a small scale, in addition to making charcoal pig iron.

#### THE TATA IRON & STEEL COMPANY, LTD.

The Tata Iron & Steel Co., Ltd., was organized in 1907, the erection of the works begun in 1908, and the first pig iron made on December 2, 1911. The plant is situated at Jamshedpur, about 155 miles west of Calcutta, and is connected with the Bengal-Nagpur Railway (running between Bombay and Calcutta) by a 3-mile branch line.

Practically unlimited supplies of raw materials—iron ore, coal, and limestone—are available within a radius of 100 miles from the plant. The ore, which contains an average of 60 percent of iron, is mined in the most modern manner in open pits by steam shovels and is conveyed to the plant in 50-ton hopper cars especially provided by the railway to take care of this traffic. Coal is from several modernly equipped mines and is used for coking purposes as well as for steam generation and metallurgical heating.

The original blast-furnace plant consisted of two 200-ton furnaces which have since been enlarged on two occasions. The present plant consists of—"A" furnace, which is now making approximately 400 tons of pig iron per day; "B" furnace, which has been enlarged on two occasions so that it now has a bosh diameter of 23 feet 3 inches and a hearth diameter of 22 feet, and therefore may be classified as a 1,000-ton furnace; "C" and "D" furnaces, which were erected during the war and had an original rated capacity of 500 tons each per day, have since had their hearth diameters increased from 17 feet to 19 feet and to 24 feet 6 inches, respectively, thus placing them in the 1,000-ton class with "D" furnace possibly to be rated at 1,200 tons. The fifth furnace, "E," is by comparison small, and although it has been enlarged it is now producing only about 300 tons daily.

The coke plant comprises 150 Wilputte by-product ovens of 13 tons capacity, 50 Koppers ovens (with by-product recovery) of 7 tons capacity, and 180 Coppee nonrecovery ovens. Supplementing these are two sulphuric acid plants with a capacity of 10,000 tons yearly.

The steel plant consists of 7 basic open-hearth furnaces of which 2 are of 60 tons capacity and 5 of 100 tons capacity. In addition the duplex plant embraces three 25-ton acid Bessemer converters, one 200-ton and two 250-ton basic tilting open hearth furnaces, and one 1,300-ton mixer.

The original steel mill set-up consisted of one 40-inch, 2-high reversing blooming mill; one 28-inch combination rail and structural mill, 2-high and 3 stands; and one 16-inch and one 10-inch bar mill, the original bar mill now being employed to manufacture fishplates for the Indian Government Railways. In connection with the so-called "greater extensions" at 40-inch electrically operated reversing blooming mill, a continuous sheet bar and billet mill consisting of six 18-inch and six 24-inch mills, and one 28-inch combination rail and structural mill consisting of two 3-high and one 2-high finishing stands preceded by a 35-inch 2-high reversing roughing mill were installed. Beyond the sheet bar and billet mills is a sheet mill originally consisting of 7 finishing mills and 5 roughing mills, but to which have been added 2 roughing mills and an additional finishing mill with automatic tables and continuous pair and pack-heating furnaces.

Other equipment installed and available includes a 12-inch Morgan merchant mill with 4 continuous 14-inch roughing stands and 2 auxiliary 8-inch mill stands; a plate mill consisting of 2 tandem three-high 96-inch electrically operated mills—these mills being equipped with heating furnaces and the necessary cranes and finishing department; and a plant for the manufacture of steel sleepers consisting of two hydraulic presses.

The works generates its own power and is well supplied as to engineering shops, laboratories, and other auxiliary equipment. To provide housing for employees a town of approximately 100,000 inhabitants has been set up. All buildings are modern in character, supplied with electric lights, ice, fans, waterborne sewage, and filtered water. There are farms as well as a dairy attached to the town's organization, and there are also a number of clubs, schools, and playgrounds, as well as a large hospital at which about 600,000 cases are treated annually—a large part of the service being rendered free of charge. The company also maintains a technical school where employees are trained to become more efficient operatives.

#### THE INDIAN IRON AND STEEL COMPANY, LTD.

This company was incorporated in 1918, began operations in 1923, and at present produces only pig iron. The company has its own iron ore, coal, and limestone mines. The works located about 142 miles from Calcutta, are connected with the main line of the East Indian Railway and with the Bengal Nagpur Railway by broad-gage sidings. The plant proper consists of two blast furnaces of the most modern design, each furnace having a capacity of 850 tons of pig iron daily. Coke ovens, for the production of coke necessary for the furnaces together with a by-products plant, have been installed.

Like the Tata Iron & Steel Co., Ltd., the Indian Iron & Steel Co., Ltd., has established its own town of Burnpur, where the company owns over 4,000 acres of land. An extensive layout of water works, hospitals, bungalows, quarters, etc., have been built to accommodate the staff and the labor required.

The company produces basic pig iron for steel making and foundry iron for castings.

### MYSORE IRON WORKS

The Mysore Iron Works is owned by the Government of Mysore. Situated at Bhadravati, the plant occupies an area of about 50 acres and comprises a modern charcoal blast furnace (of about 80 tons capacity per day) with a supporting wood-distillation and by-products recovery plant. A modern plant for the manufacture of cast-iron pipes has also been installed. The construction of the works commenced in 1918, operation being started in 1923.

The Mysore Iron Works produce charcoal iron which is especially suitable for the manufacture of chilled castings, malleable castings, and special steels.

### THE BENGAL IRON CO., LTD.

This company (formerly the Bengal Iron & Steel Co., Ltd.) took over the old Barakar Iron Works Co. in 1889, when the whole plant was remodeled and the production of pig iron was commenced. Its furnaces have been out of blast since early in 1931.

The works of the company, occupying an area of 2,300 acres of land, are situated at Kulti, Bengal, about 144 miles from Calcutta on the East Indian Railway with a siding connecting the works with the Bengal-Nagpur Railway.

The present blast-furnace plant comprises five furnaces. Two are modern mechanically charged furnaces, capable of a combined output of 800 tons of pig iron per day. The works have their own coke ovens and by-product plant. The Bengal Iron Co. specializes in the manufacture of cast-iron pipes and cast-iron sleepers.

As with the other iron companies the town of Kulti is self-contained and equipped with its own power plant, water works, hospitals, and bungalows.

In addition to the foregoing there are a number of individual mills doing remelting and/or rerolling. Some are operated in connection with engineering plants manufacturing castings and shapes for their own construction work, some are operated by the Government arsenals, 1 is run by the Tinsplate Co. of India, Ltd., 1 by the Indian Steel Wire Products Co., while 2 make castings and merchant shapes for resale. In addition to these some workshops of the railways and larger mills also operate small melting furnaces.

### PIG IRON

The total rated capacity of India's blast furnaces is 1,750,000 gross tons of pig iron per year. On January 1, 1933, there were 13 blast furnaces in India, but owing to the depressed condition of the industry and the obsolescence of 3 smaller units, only 5 were in blast throughout the year. The following table shows the number of blast furnaces in operation, tons of ore smelted, and tons of pig iron made between 1920 and 1932:

Years	Average number of furnaces in blast	Gross tons of pig iron made	Gross tons of iron ore smelted	Years	Average number of furnaces in blast	Gross tons of pig iron made	Gross tons of iron ore smelted
1920.....	6	311,257	505,240	1927.....	9	1,140,050	1,816,701
1921.....	7	369,260	590,119	1928.....	9	1,051,885	1,723,096
1922.....	9	340,422	553,982	1929.....	9	1,391,537	2,315,031
1923.....	10	623,067	990,918	1930.....	7	1,174,957	1,918,878
1924.....	11	872,547	1,395,196	1931.....	6	1,058,234	1,710,275
1925.....	8	830,075	1,394,788	1932.....	5	913,535	1,472,413
1926.....	7	992,404	1,447,950				

Pig iron is produced in India only in blast furnaces using coke and/or charcoal, and in 1932 of the 913,535 tons of pig iron produced only 1.6 percent was produced with charcoal. The grades of pig iron currently produced in India include basic pig—sand or machine cast, special and hot—for basic steel production in the open hearth; foundry iron; and acid Bessemer pig for the manufacture of basic steel by the duplex method. Special materials such as ferrosilicon, ferromanganese, spiegeleisen, etc., can be made to order, but the limited regular demand for these ferro-alloys is met by importation.

A tabular presentation of the analysis of a number of standard grades of Indian pig iron follows:

ANALYSES OF VARIOUS GRADES OF INDIAN PIG IRON <sup>1</sup>

[All figures in percent]

Producer and grade	Carbon		Silicon	Phosphorus	Manganese	Sulphur
	Graphitic	Com- bined				
Bengal Iron Co.:						
Grades 1, 2, and 3.....	3.13	0.23	2.25	1.20	1.40	0.22
Grades 3 and 4.....	2.98	.32	2.00	1.21	1.13	.04
Tata Iron & Steel Co., Ltd.:						
Grade 1.....			<sup>2</sup> 2.50	.35- .40	1.25-1.50	.025
Grade 2.....			2.00-2.50	.35- .40	1.25-1.50	.03 - .035
Grade 3.....			1.50-2.00	.35- .40	1.25-1.50	.035- .05
Grade 4.....			1.00-1.50	.35- .40	1.25-1.50	Under .04
Basic.....			Under 1.00	.35- .40	1.25-1.50	Under .04
Mysore Iron Works: Charcoal pig iron <sup>3</sup> .....	3.5 to 4.8		.2 to 3.5	.06 to .15	.2 to 2.5	.02

<sup>1</sup> These analyses are given in as complete detail as is possible from available information. The omission of a figure should be interpreted as conclusive evidence, therefore, that the pig iron described did not contain any of the element in question.

<sup>2</sup> And over.

<sup>3</sup> Also contains 0.02 to 0.13 percent chromium and 92 to 94 percent iron.

There is no electric smelting of ore done in India. While this subject has been discussed from time to time, in a more or less academic way, there is no immediate likelihood of the replacement of coal by electricity for this purpose, although India has large water-power resources, both developed and undeveloped.

Bengal has never attempted to develop hydroelectric schemes, probably due to the availability of cheap coal, but the snow-fed Testa River, with a minimum cold-weather flow of 10,000 cubic feet per second, offers a first-class source of possibly 200,000 kilowatts some 200 miles from the center of the iron and steel industry.

The annual consumption of iron as such in India is estimated at approximately 100,000 tons. Probably the largest single use to which this is put is the manufacture of cast-iron railway sleepers, with the manufacture of cast-iron pipe of various diameters next. Little or no iron is used by the individual Indian in his domestic life, and his requirements in this regard are commonly considered satisfied by the familiar iron rice bowl—other cooking utensils, sanitary equipment, etc., such as is common in America and other western countries not finding any widespread employment.

### STEEL PRODUCTION

The trend of steel production in India has been generally upward from 1920, when the total was 156,240 tons, to 1931, when 628,115 tons were made—exceptions to this general movement being indicated in 1922 and 1928, when production was below that of the preceding year. The year 1932 showed a reduction to 572,187 tons, and the coming 2 years will probably not see this figure exceeded, for the newly acquired tariff advantage and the resulting additional market for sheet bars thus created will probably be offset by the curtailed railway program, further Government retrenchments, and the absence of any new engineering projects of large size such as have been underway during the past few years.

The following table analyzes Indian steel production during the past 13 years:

#### PRODUCTION OF STEEL IN INDIA SINCE 1920, BY METHODS OF PRODUCTION

(In gross tons)

Year	In duplex and tilting furnaces	In open-hearth furnaces (basic)	From scrap in electric furnaces		Other castings made in foundries	Total
			Ingots	Castings		
1920		156,240				156,240
1921		182,689			906	183,595
1922		150,475	20	30	1,386	151,911
1923	27,491	187,974	56	309	1,610	217,440
1924	129,575	205,867	7	574	1,132	337,155
1925	235,050	213,603	20	679	2,807	452,159
1926	288,695	233,058	279	450	2,789	525,271
1927	330,564	243,532	471	694	2,797	578,058
1928	227,100	182,610	383	637	2,002	412,732
1929	320,598	254,712	108	1,047	3,246	579,706
1930	381,571	237,351	15	1,998	2,792	623,727
1931	405,307	219,841	20	938	2,009	628,115
1932	380,471	189,339	2	723	1,652	572,187

The only steel produced in India from native materials is basic open-hearth steel made in stationary open-hearth furnaces and by the duplex method and tilting furnaces. There is no direct production from iron in electric furnaces, the few electric furnaces in operation only remelt scrap steel.

The Tata Co. is the only steel producer (save for a limited tonnage made by the Mysore Iron Works in electric furnaces), and their present capacity is about 600,000 tons a year. On their present basis of operations, between 65 and 70 percent of their pig-iron production goes into steel, and their steel production averaged 560,000 tons per annum over the past 5 years.

The following tabulation of finished steel production does not represent the total Indian output, for the reason that no figures are available from private engineering works, Government arsenals, railway and tramway workshops, and numerous other establishments operating small remelting furnaces for making their own requirements for construction and repair work. It is believed, however, that the figures represent the total output of the items listed.

## INDIAN OUTPUT OF FINISHED STEEL PRODUCTS

[In gross tons]

Item	1921	1922	1923	1924	1925	1926
Rails, heavy, 50 pounds and over	73,561	61,497	76,945	92,375	113,493	144,003
Rails, light, under 50 pounds	9,508	2,089	2,350	4,671	6,510	5,317
Beams	9,561	15,218	14,411	19,909	17,044	13,581
Bars	15,464	17,621	25,241	27,489	52,336	60,453
Channels	3,286	4,499	1,520	5,909	7,530	9,035
Angles	4,770	5,412	6,646	12,651	15,271	16,339
Tees	1,374	1,374	2,476	2,787	4,415	3,957
Fishplates	4,126	2,762	3,240	5,196	4,685	6,186
Steel sleepers					1,579	586
Tin-plate bars				18,968	40,067	49,166
Sheet bars				9,971	34,796	33,265
Hoe bars						
Tie bars						
Plates			17,909	20,588	20,047	25,890
Black sheets				1,071	27,090	23,194
Plain galvanized sheets				346	10,659	13,327
Corrugated sheets				346	8,809	10,458
Tin plate			9,100	20,763	29,477	35,625

  

Item	1927	1928	1929	1930	1931	1932
Rails, heavy, 50 pounds and over	169,856	100,443	141,805	114,523	70,471	27,703
Rails, light, under 50 pounds	4,078	3,051	1,893	2,409	187	462
Beams	20,126	10,205	17,985	26,809	65,252	55,754
Bars	63,477	41,135	73,519	68,069	75,868	77,436
Channels	7,381	2,602	7,932	10,949	5,937	4,376
Angles	17,568	20,427	24,366	29,870	22,701	20,327
Tees	5,056	5,550	6,901	9,995	11,854	10,493
Fishplates	5,875	5,085	4,026	5,499	2,327	2,336
Steel sleepers	2,711	2,319	6,713	3,985		4,474
Tin plate bars	61,352	46,534	53,062	62,424	40,336	77,555
Sheet bars	34,469	19,912	48,915	67,482	100,292	77,323
Hoe bars					771	2,771
Tie bars	2,803	265		1,283	2,068	
Plates	24,854	18,395	31,214	33,654	27,509	28,751
Black sheets	24,562	17,313	35,971	47,387	47,669	59,519
Plain galvanized sheets	9,106	7,900	17,672	24,575	27,680	43,691
Corrugated sheets	6,142	4,803	13,517	17,002	21,136	32,937
Tin plate	43,491	38,263	34,857	39,782	38,001	43,912

## EMPLOYMENT

Steel-mill labor in India is drawn, like practically all industrial labor, from agricultural classes. The problem of the industry, therefore, has been to create a steadily available supply of trained labor from entirely inexperienced and wholly agricultural-minded people from practically every part of India. The resultant supply is considered satisfactory after long and careful training, and with capable supervision. It is not cheap, for although individual daily or monthly earnings are far lower than in the United States and Europe, it takes double or more than double the number of hands to do a given job, or to attend a given machine. Highly skilled Indian labor working with automatic or semiautomatic machinery is very efficient, but due to local conditions many operations such as loading are performed manually, and these operations are inefficient and costly. It is believed that approximately 90 percent of the present labor in the iron and steel industry is illiterate.

It cannot be said that industrial labor is subject to unemployment in India to the same extent as in more advanced industrial countries as, due to the close family system and the fact that practically all labor is primarily agricultural, steel-mill laborers during a lay-off for

any reason are able to return to their family farms, of which in most cases they are part owners. However, only once in the modern history of the industry has there been what could be called unemployment on any large scale, and this was in 1928, when the Tata Iron & Steel Co., on the recommendation of the Tariff Board, who had emphasized the necessity for the reduction of the number of laborers, thinned out their ranks. This resulted in a strike which tied up the works for the best part of a year. The Tata Iron & Steel Co., in the fiscal year 1925-26, employed over 32,000 laborers and in 1926-27 employed 32,500. In the next year this was reduced by more than a thousand, and in 1928-29 it was cut down to 28,840. Since that time the number of employees, as mentioned elsewhere, has been reduced to about 25,000 through improved equipment and increased efficiency.

According to the investigations of the Royal Commission on Labor in India the average working hours in the iron and steel industry is a 48-hour week divided into 8-hour shifts. They found that the average hours of labor per week including overtime were between 51 and 52 while in some continuous processes it increased to as high as 56.

The Tata Co., employing 25,000 laborers gives 1 month holiday a year at full pay to its monthly paid staff, while its daily paid hands are allowed 2 weeks. Two additional days on full pay each year are granted for religious festivals. At the end of 7 years' continuous service, employees drawing 30 rupees<sup>1</sup> per month or more are allowed 6 months leave on half-pay. Also 5 days per year on full pay is allowed for sickness and urgent private affairs. Accident pay at full rates up to 6 months may be allowed, and in case of death through unavoidable accident 1 year's full pay is allowed the family. A works' provident fund has been in effect since 1920 whereunder employees drawing 15 rupees per month or over may deposit one twenty-fourth of their wages, to which the company will add one twelfth or double the amount. The fund bears interest at 6 percent.

It is impossible to obtain detailed and up-to-date wage figures, and while the following statement shows mere approximations they are near enough to actual rates to provide an excellent indication of the present wage levels:

	Daily wage			Daily wage	
	Rs.	a.		Rs.	a.
<b>Blast furnaces:</b>			<b>Merchant mills—Continued.</b>		
Stove tenders.....	2	4	Heaters.....	4	9
Assistant stove tenders.....	1	8	Pusher operators.....	1	12
Keppers.....	2	8	Door operators.....	1	4
Slag firemen.....	1	4	Chargers.....	1	6
Slag dumpers.....	0	12	Furnace-control drivers.....	1	10
Fitters.....	2	8	Billet recorders.....	2	10
Fitter helpers.....	1	4	Rollers.....	12	0
Blacksmiths.....	2	2	Assistant rollers.....	6	0
Riggers.....	1	8	Roughers.....	4	9
Skip operators.....	1	12	Tongsman.....	2	7
Truck drivers.....	1	8	General utility man.....	4	4
<b>Merchant mills:</b>			Roll fitters.....	3	2
Billet-yard foreman.....	2	10	Control drivers.....	1	13
Steam-hammer operator.....	2	2			
Straightener laborers.....	0	12			
Heaters in charge.....	5	10			

<sup>1</sup> The par value of the rupee is \$0.3650 United States currency.

The average rate per day, including those given above and other labor in merchant mills, is around 1.88 rupees per day.

There is only one labor union worthy of the name in the industry and that is at the Tata plant and is the relic of the strike of 1928 mentioned above. It cannot be said that this union is an effective force, and efforts to form unions at other mills have proved unsuccessful. On the whole, very little trouble is experienced from labor disputes in the industry.

### ECONOMIC CONDITIONS

The Indian iron and steel industry depends to a great extent upon Government purchases, particularly in connection with railway, engineering, and other materials, for a large part of its orders, and the fairly heavy railway construction programs carried through from 1920 to 1930 proved a decided boon to the industry. During this period the Government of India's policy of discriminating protection for indigenous industries likewise became effective and the steel industry has been tremendously benefited through repeatedly enhanced tariff protection as well as bounties. However, Government construction programs, both as regards railways and engineering projects, have been tapering off rapidly since the end of 1930 and the Indian industry might have found itself in a very unfortunate position had it not been for the enactment of compensating tariff increases which discouraged the importation of foreign iron and steel.

Comparative Calcutta wholesale-price figures, using July 1914 as 100, are given below for 1922, 1928, and 1931, also for December 1932, from which it will be noted that important items protected by tariffs have held up extremely well (metals, cotton manufactures, and sugar), while the raw products of the country have shown tremendous declines.

#### CALCUTTA WHOLESALE PRICE INDEXES

[July 1914 equals 100]

Commodity	1922	1928	1931	Dec. 1932
Cereals.....	137	133	78	64
Pulses.....	152	157	89	92
Sugar.....	221	165	135	139
Tea.....	159	154	86	57
Other food articles.....	186	157	111	95
Oilseeds.....	147	142	82	77
Mustard oil.....	116	110	68	62
Jute, raw.....	110	100	49	38
Jute manufactures.....	144	150	76	70
Cotton, raw.....	191	167	83	89
Cotton manufactures.....	239	159	123	112
Other textiles (wool and silk).....	162	139	68	58
Hides and skins.....	120	134	67	59
Metals.....	175	125	109	104
Other raw and manufactured articles.....	235	138	101	96
Building materials (teakwood).....	131	150	150	124
All commodities.....	176	145	96	88

The item of metals in this comparison includes iron hoops, Tata no. 1 foundry pig, Tata no. 4 foundry pig, galvanized corrugated sheets 24 B.W.G., tin block, and copper braziers. The price comparisons in the following table are of interest in this connection:

## DECLARED VALUE PER UNIT OF CERTAIN IMPORTED IRON AND STEEL ITEMS

Articles	Pre-war average			1929-30			1930-31			1931-32		
	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.	Rs.	a.	p.
Iron, bars and channel.....do.....	118	4	2	178	10	11	155	11	4	216	8	3
Beams.....do.....	115	5	6	125	12	4	120	14	1	109	15	7
Nails, etc.....do.....	205	1	6	289	6	4	273	2	6	289	6	10
Pipes, etc.....do.....	150	10	9	265	15	11	340	10	11	281	13	1
Rails, chairs, etc.....cwt.....	3	11	6	6	13	3	7	5	2	10	11	1
Sheets, galvanized.....ton.....	192	0	1	215	12	9	196	2	10	197	6	6
Sheets, tinned.....do.....	236	15	1	320	6	2	317	6	11	261	8	2
Sheets, not galvanized.....do.....	139	6	0	132	11	0	134	12	5	129	2	0
Tubes.....do.....	231	8	4	296	7	11	304	9	7	299	12	5
Steel, bars.....do.....	99	7	7	113	11	9	104	5	5	89	11	10

## FINANCIAL RESULTS

Owing to the favorable factors above outlined, the various companies have done very well in comparison to the performance of other companies comprising the Indian industries, and probably as compared with iron and steel manufacturers elsewhere as the following statements of profits from 1922 to 1931, inclusive, show.

## PROFITS OF THE INDIAN IRON AND STEEL INDUSTRY

Year	Tata Iron & Steel Co.	Indian Iron & Steel Co.	Bengal Iron Co.	Year	Tata Iron & Steel Co.	Indian Iron & Steel Co.	Bengal Iron Co.
	<i>Rs.</i>	<i>Rs.</i>	<i>£</i>		<i>Rs.</i>	<i>Rs.</i>	<i>£</i>
1922.....	8,386,004	478,905	102,210	1927.....	14,834,316	1,728,976	209,161
1923.....	2,059,226	213,825	194,571	1928.....	10,980,541	3,473,545	314,381
1924.....	3,132,007	402,187	240,601	1929.....	4,605,712	3,367,729	261,413
1925.....	6,471,013	-206,098	75,825	1930.....	8,226,100	1,977,803	203,702
1926.....	9,572,685	463,357	-43,022	1931.....	9,912,938	1,363,584	-22,764

The Mysore Iron Works is a Government concern and no figures are available. It will be noted that the Bengal Iron Co. showed a loss in 1926 and in 1931, the Indian Iron & Steel Co. in 1925; and while the Tata Iron & Steel Co. had a loss during 1929 (their strike in 1928 cost them around 20,000,000 rupees), they showed an actual book-keeping profit by transferring 5,000,000 rupees from reserves.

It is difficult to determine the exact amount of investment in the industry. Detailed statements are not available and the companies own mines and quarries which are carried in their general accounts. However, in their balance sheet of March 31, 1931, the Tata Iron & Steel Co. carried a gross block account of 234,000,000 rupees from which had been written off 82,000,000 rupees in depreciation. The Bengal Iron Co. carried a block expenditure of £2,494,000, which is approximately 31,170,000 rupees, and the Indian Iron & Steel Co. estimate their gross block at 27,000,000 rupees less some 5,000,000 rupees for depreciation. Taking these figures as a basis we arrive at a total investment in the industry of approximately 295,000,000 rupees, excluding the Mysore Iron Works for which comparable data are not available.

### ORGANIZATION WITHIN THE INDUSTRY

The Indian industry has no organization through which it presents a united front in the case of tariff proposals, etc., although the Indian Metallurgical Association is a body which could be utilized in this connection if the industry desired and, in fact, on several occasions the testimony of the Indian Metallurgical Association has been called in for tariff studies.

From time to time it has been alleged, and it is common rumor throughout the trade, that the three principal pig-iron producers operate what is known as the "pig-iron pool" to control prices at around import levels, divide sales territories, and otherwise mutually protect the interests of the pig-iron industry. During the course of their study of the industry in 1929, the efforts on the part of the Indian Tariff Board to substantiate this resulted in a statement by that body, to the effect that the results of the tender called for by one of the railways, at the instigation of the Tariff Board, for certain quantities of pig iron of comparable quality f.o.r. a given point in India failed to prove these statements. The result of the bids they received showed that imported pig iron was quoted at 81 rupees, 9 annas, 8 pies, producer A quoted 68 rupees, 13 annas, producer B, 65 rupees, 15 annas, 9 pies, producer C, 70 rupees, 15 annas, 9 pies, and producer D, 65 rupees.

The Indian industry is party to no international agreements, with the exception of the agreement, recently entered into between the Indian manufacturers of sheet bars and the British galvanized-sheet makers, in connection with the supplementary agreement on galvanized sheets arrived at between Great Britain and India as a result of the Ottawa Conference. This agreement in effect provides that Indian producers will be permitted to dispose of their full output of galvanized sheets (which will soon be 80,000 tons per annum) before British sheets will come into the market. Indian manufacturers of sheet bars will sell about 84,000 tons annually to British sheet makers and the resulting, say, 70,000 tons of sheets will enter India at a preferential rate of 30 rupees per ton and will be sold by the Indian sheet bar producers. The rate on sheets rolled in the United Kingdom from other than Indian sheet bar is 53 rupees per ton, and sheets from foreign countries will have to pay 83 rupees per ton.

### FOREIGN TRADE IN IRON AND STEEL

Although India's productive capacity for iron and steel has been greatly increased in recent years, the demand for iron and steel products is still, and will probably continue to be, far ahead of domestic supply, and India will undoubtedly remain a good buyer, particularly from the British industry under the tariff preference now in force.

In 1923 the Government of India adopted a tariff policy of "discriminating protection", and created the Indian Tariff Board as a body to study applications for tariff protection, the steel and allied manufacturing industries being one of the earliest studies of the board. Tariff protection and bounties were granted the steel industry in 1924 as a result of the board's findings, and in 1927 there was a wholesale revision of duties and of bounties, and preferential rates were granted to certain British iron and steel products to help overcome continental competition in the Indian market. The provisions

of the 1927 act were to operate until 1934, when a statutory inquiry into the iron and steel industry is scheduled.

The steel industry protection act of 1928 introduced a duty of 2 rupees per hundredweight on iron and steel bolts. Additional protective duties were imposed on imported galvanized sheets from 1930 at the rate of 37 rupees per ton. By the steel industry protection act of 1931 the Government imposed a duty of 2 rupees, 4 annas per hundredweight on imported bolts and nuts and a further bounty of 20 rupees for each ton of rails delivered under the contract for 1930-31, was given to Messrs. Tata & Sons. In 1931 a duty of 45 rupees per ton was placed on imported wire and wire nails. Out of the Ottawa Conference in 1932 came a separate agreement on galvanized sheets between Great Britain and India which provides for the following preferences:

(1) Sheets made in the United Kingdom from Indian sheet bars, 30 rupees a ton; (2) sheets made in the United Kingdom from other sheet bars, 53 rupees a ton, as compared with (3) sheets not made in the United Kingdom, 83 rupees, 12 annas a ton.

In addition to this special treatment of Empire sheets, the general Ottawa agreement gave a preference of 10 percent to certain iron and steel products of Great Britain not previously receiving preferences.

#### IMPORT TRADE

The development of the local industry since 1913 has just about kept pace with the growth of demand within the country; and if figures of the past 2 years of abnormally low purchasing are eliminated, the average imports for the 3-year period 1926-29 is 1,070,000 tons against the 1913 figure of 1,018,000 tons.

Imports during the 5 years 1926-27 to 1930-31 (April-March) are shown in the following table:

#### IMPORTS OF IRON AND STEEL PRODUCTS INTO INDIA

[In gross tons]

Commodity	1926-27	1927-28	1928-29	1929-30	1930-31
Crude or semifinished material:					
Iron:					
Pig.....	1,627	5,104	3,160	3,262	3,063
Angle, tee, bolt, and rod.....	306	597	1,424	325	1,216
Bars and channels.....	10,457	4,949	5,345	4,798	4,198
Rice bowls.....	750	431	265	257	152
Steel:					
Angle and tee.....	46,637	65,992	66,773	55,501	27,606
Spring.....	5,672	2,200	583	90	492
Bars (other than cast steel).....	151,096	181,075	169,846	169,304	87,370
Cast:					
Tool steel:					
High speed.....	586	299	415	422	316
Carbon.....	1,449	418	315	521	254
Cast steel bars.....	329	355	469	329	312
Other cast steel.....	171	547	687	477	229
Ingots, blooms, billets, and slabs.....	410	28,369	9,469	8,815	1,527
Total crude or semifinished material.....	219,490	290,236	258,752	244,101	126,845

## IMPORTS OF IRON AND STEEL PRODUCTS INTO INDIA—Continued

[In gross tons]

Commodity	1926-27	1927-28	1928-29	1929-30	1930-31
<b>Finished material:</b>					
<b>Iron or steel:</b>					
Anchors and cables.....	1,381	1,847	1,099	1,346	864
Beams, channels, pillars, girders, and bridge-work.....	71,652	144,368	135,801	104,861	86,773
Bolts and nuts.....	11,330	10,265	15,857	12,551	8,917
Fencing materials including fencing wire.....	7,051	9,378	9,825	10,048	7,407
Hoops and strips.....	35,351	33,011	38,583	39,218	33,349
Nails, rivets, and washers (excluding wire nails).....	17,322	18,562	18,671	16,682	13,938
Old for remanufacture.....	5,954	2,172	1,901	1,669	3,414
Pipes and fittings.....	9,080	15,672	10,305	5,760	3,001
Rails, chairs, and fishplates including those for railways.....	22,637	113,190	48,135	26,065	10,586
Screws:					
Wood screws.....		1,730	1,093	1,460	1,321
Metal thread screws.....		988	1,389	621	298
Total screws.....	2,129				
Sheets and plates:					
Galvanized:					
Corrugated.....	254,185	301,521	298,127	230,429	127,051
Plain.....	20,634	29,983	28,110	27,123	20,381
Tinned:					
Tin plates.....	22,188	23,357	26,974	31,087	17,229
Other sorts.....	56	1,092	203	78	22
Not galvanized or tinned:					
Sheets up to ½ inch thick.....	28,402	33,605	34,746	24,151	19,423
Plates over ½ inch thick.....	31,208	44,206	44,118	36,908	19,093
Other sorts.....	2,357	1,927	1,135	874	815
Sleepers and keys of steel or iron for railways.....			85,036	65,759	16,534
Tubes, pipes, and fittings, wrought.....	29,942	46,980	35,488	34,072	37,757
Wire nails.....	14,498	13,433	17,911	12,505	12,409
Wire rope:					
Black.....	1,603	2,155	2,316	1,879	1,932
Galvanized.....	1,424	2,085	1,954	1,456	1,355
Wire other than fencing wire.....	5,713	8,003	9,982	8,732	12,345
Other manufactures of iron or steel.....	29,859	46,995	42,416	33,450	31,147
<b>Total, finished material.....</b>	<b>625,956</b>	<b>907,025</b>	<b>911,175</b>	<b>728,584</b>	<b>487,361</b>
<b>Total imports, all iron and steel products.....</b>	<b>845,446</b>	<b>1,197,261</b>	<b>1,169,927</b>	<b>972,685</b>	<b>614,206</b>

Due to changing conditions of construction and general widening of the market for iron and steel products, the past 5 years indicate large proportional importations of beams and pillars, hoops and strips, nails, rivets and washers, pipes and tubes, wire and wire manufactures, and miscellaneous iron and steel items. The rather surprising item of pig iron imports consists principally of hematite, which is brought in for special purposes, principally by the Government arsenal. A certain proportion of Scotch iron is also imported by some of the jute mills in the Calcutta area. These two sources of demand accounting for virtually the entire importation.

## IMPORTS OF IRON AND STEEL INTO INDIA BY COUNTRIES OF ORIGIN

[In gross tons]

Countries of origin	1926-27	1927-28	1928-29	1929-30	1930-31
<b>All imported iron and steel:</b>					
United Kingdom.....	406,221	685,016	649,534	485,778	269,170
Belgium.....	256,734	316,144	333,324	312,338	207,432
Germany.....	79,028	78,571	69,958	57,733	43,746
United States.....	28,621	16,412	18,007	15,952	14,979
France.....	32,973	47,974	53,806	34,833	29,108
Other countries.....	41,869	53,144	45,298	66,051	49,771
<b>Total.....</b>	<b>845,446</b>	<b>1,197,261</b>	<b>1,169,927</b>	<b>972,685</b>	<b>614,206</b>

## IMPORTS OF IRON AND STEEL INTO INDIA BY COUNTRIES OF ORIGIN—Continued

[In gross tons]

Countries of origin	1926-27	1927-28	1928-29	1929-30	1930-31
<b>Crude or semifinished material:</b>					
<b>Iron:</b>					
United Kingdom.....	3,516	6,440	4,322	4,879	4,672
Belgium.....	7,747	2,043	3,142	2,475	2,118
Germany.....	42	527	608	64	1,078
United States.....	2				1
France.....	100	51	101		8
Others.....	1,733	2,020	2,022	1,224	772
<b>Total.....</b>	<b>13,140</b>	<b>11,091</b>	<b>10,195</b>	<b>8,642</b>	<b>8,649</b>
<b>Steel:</b>					
United Kingdom.....	21,124	52,468	78,395	55,308	33,383
Belgium.....	115,106	139,130	103,077	108,723	56,549
Germany.....	33,972	40,776	26,875	18,681	3,853
United States.....	15	1	77	28	14
France.....	15,878	19,763	21,065	11,480	6,994
Others.....	20,255	26,817	19,248	41,239	17,403
<b>Total.....</b>	<b>206,350</b>	<b>279,155</b>	<b>248,557</b>	<b>235,459</b>	<b>118,196</b>
<b>Finished material:</b>					
<b>Iron or steel:</b>					
United Kingdom.....	381,581	625,908	566,817	425,591	231,115
Belgium.....	133,881	174,971	227,105	201,140	148,765
Germany.....	45,014	37,268	42,675	38,968	38,815
United States.....	28,604	16,411	17,930	15,924	14,964
France.....	16,995	28,160	32,020	23,353	22,106
Others.....	19,881	24,307	24,028	23,588	31,696
<b>Total.....</b>	<b>625,956</b>	<b>907,025</b>	<b>911,175</b>	<b>728,584</b>	<b>487,361</b>

The participation of British mills in the iron and steel trade of India has declined in recent years. In the fiscal year 1927-28, 57 percent of all iron and steel imported into India came from the British Isles. In 1928-29 this proportion was 56 percent, in 1929-30, 50 percent, and in 1930-31 only 44 percent. India's decline in importance as a market for British steel has also been marked. In 1927 21 percent of Britain's exports went to India, in 1928 the proportion declined to 18.7 percent, in 1929 to 15 percent, in 1930 to 11.8 percent, and in 1931 it was only 10.7 percent of the total tonnage sent to foreign and British Colonial markets. Even so, India was, in 1931, Great Britain's chief market, exceeding South Africa by a narrow margin.

As the foregoing tables indicate, India's imports have declined heavily; and while no great change in the source of total supply has occurred during the past 5 years, galvanized sheets is one outstanding item which has shown displacement. In 1926-27 India imported 274,819 tons of galvanized sheets, this tonnage constituting 30 percent of the total iron and steel imports. During the fiscal year 1930-31 India's imports of this item totaled 147,432 tons, and but 23.5 percent of its total iron and steel imports. In 1926-27 galvanized sheets comprised 58.4 percent of Great Britain's total exports of iron and steel products to India, while in 1930-31 this item accounted only for 33 percent. In the former year the United Kingdom supplied slightly over 90 percent of the total quantity imported. The increased Indian manufacturing capacity is likewise an important factor in reducing imports, as domestic sheet capacity is now sufficient to supply 40 percent of normal requirements.

It is believed in India that the new duties, based on the "Ottawa Iron and Steel Agreement," will materially mend the position of

British-made sheets in this market, while the protective duties already in effect coupled with the additional protection given to many items in the general Ottawa agreement will do much to assist the British industry to regain its hold on the local iron and steel trade.

The following table shows United Kingdom export figures for the years 1927-31, inclusive, which give details of India's share of total exports of iron and steel products:

#### UNITED KINGDOM EXPORTS OF IRON AND STEEL

[In gross tons]

Countries to which consigned	1927	1928	1929	1930	1931
Total to foreign countries.....	1,866,445	2,007,774	2,108,712	1,560,034	758,427
Total to British colonies.....	2,529,761	2,252,688	2,270,829	1,599,027	829,410
Grand total.....	4,396,206	4,260,462	4,379,541	3,159,661	1,980,617
British India.....	834,804	734,370	614,768	346,058	211,411
Percent of total.....	19.9	17.2	14	10.9	10.7

<sup>1</sup> Includes 392,780 tons of iron and steel exported but "unallocated" as to country of destination.

The share of the United States in the iron and steel market of India is insignificant. In 1926-27 the total was 29,127 tons, of which 12,088 tons was galvanized sheets and 10,625 tons tin plate, these two items accounting for 78 percent of the total. In 1930-31 the total tonnage from the United States decreased to 14,994 tons and of this 1,898 tons was galvanized sheets and 8,752 tons tin plate, the combined figures equaling 71 percent of the total share. In the latter year the remaining 29 percent included 851 tons of pipes and tubes, 370 tons of fencing material, 317 tons of hoops and strips, and a quantity of miscellaneous items. The failure of American manufacturers to secure more of this trade is due to their inability to meet continental prices on an equal tariff basis, and British prices over their tariff advantage. Since 1931 a large oil company, formerly using American tin plate, has used the local product due to price.

Details of the United States export trade with British India in iron and steel products follows—the declining volume described in the preceding paragraph on the basis of Indian statistics being borne out by this official American data. Of especial interest is the sharp decline in shipments of tin plate, galvanized sheets, and several items of tubular products.

#### UNITED STATES EXPORTS OF IRON AND STEEL TO INDIA, 1929-32

[In gross tons]

Item	1929	1930	1931	1932
Iron and steel scrap (including tin-plate scrap).....			20	
Bars, steel.....	92	28	60	1
Bars, alloy steel.....	1		1	1
Wire rods.....	48	30	19	2
Plate, not fabricated.....	60	34		
Iron sheets, galvanized.....		305	42	
Steel sheets, galvanized.....	3,179	1,520	432	8
Steel sheets, black.....	17	50	2	4
Iron sheets, black.....	13	20	5	

## UNITED STATES EXPORTS OF IRON AND STEEL TO INDIA, 1929-32—Contd.

[In gross tons]

Item	1929	1930	1931	1932
Strip steel, cold rolled.....	1	6	-----	-----
Hoop, band, and scroll iron or steel.....	5	224	445	7
Tin plate or terne plate.....	10,034	10,616	618	-----
Water, oil, gas, and other tanks, except lined, etc.....	-----	640	4	1
Structural shapes, not fabricated.....	63	214	-----	-----
Structural shapes, fabricated.....	283	4,363	4,924	280
Plates, fabricated, punched or shapes.....	-----	-----	13	4
Metal lath.....	31	34	4	-----
Frames, sashes, and sheet piling.....	148	230	-----	-----
Rails, 50 pounds and over, per yard.....	1,249	618	10	-----
Rails, under 50 pounds, per yard.....	100	-----	-----	-----
Rail joints, splice bars, fishplates, and tie plates.....	55	33	243	5
Switches, frogs, and crossings.....	15	2	1	-----
Railroad bolts, nuts, washers, and nut locks.....	1	-----	-----	-----
Boiler tubes, seamless.....	42	22	40	3
Boiler tubes, welded.....	-----	-----	30	-----
Casing and oil-line pipe, seamless.....	2,879	2,254	1,290	337
Casing and oil-line pipe, welded.....	-----	-----	44	-----
Malleable iron screwed pipe fittings.....	217	247	221	53
Cast-iron screwed pipe fittings.....	45	4	29	2
Cast-iron pressure pipe and fittings for.....	19	4	-----	-----
Cast-iron soil pipe and fittings for.....	8	122	-----	-----
Welded black-steel pipe.....	839	630	566	711
Welded black wrought-iron pipe.....	-----	134	-----	-----
Welded galvanized steel pipe.....	201	984	1,875	1,660
Welded galvanized wrought-iron pipe.....	-----	3	32	-----
Plain iron or steel wire.....	1	19	-----	-----
Galvanized wire.....	82	113	92	-----
Barbed wire.....	-----	29	38	-----
Woven wire fencing.....	364	193	80	20
Woven wire screen cloth.....	20	27	18	13
Wire rope.....	69	62	34	10
Insulated iron or steel wire and cable.....	-----	1	1	-----
Other wire and manufactures.....	360	114	138	54
Wire nails.....	-----	1	-----	-----
Horseshoe nails.....	23	16	12	-----
Other nails including staples.....	10	11	6	-----
Ordinary bolts, machine screws, nuts, rivets, and washers.....	275	131	67	54
Iron castings.....	108	9	2	4
Steel castings.....	116	40	10	-----
Car wheels and axles.....	23	47	6	-----
Iron and steel forgings, n.e.s.....	11	22	21	1
Total.....	21,107	24,196	11,495	3,236

Germany is not an important supplier of iron and steel to this market. Its share in 1926-27 was approximately 10 percent, and this decreased to 7 percent in 1930-31. During the latter year its percentage share in iron angles and channels was slightly improved, as was its percentage under iron or steel structural shapes, galvanized sheets, pipes, and a few other items. Steel items on the other hand, principally bars, lost ground and totals under this head were only about one tenth of its 1926-27 tonnage.

The principal items imported from France are structural shapes, and a small but steady trade is done in these. In 1926-27 France supplied 35,108 tons of iron and steel to India while in 1930-31, with the total imports down 32 percent its total was 29,109 tons.

The Government of India is an insignificant factor in the import market at present, its total purchases of imported iron and steel in 1930-31 being 11,325 tons. Government purchases are of prime importance to the indigenous industry, which relies on orders for railway and engineering materials for a very large percentage of its sales, and it is the Government's policy to buy Indian products wherever possible.

## EXPORT TRADE

Pig iron constitutes roughly 87 percent of all iron and steel products exported from India, and in 1930-31 approximately 81 percent of all exports of this item was taken by Japan, the United Kingdom, and the United States.

Exports of pig began before the war, the total in 1913-14 being 82,600 tons, of which Japan took 65,400 tons and Australia 10,500 tons. However, the real growth of the trade started about 1921, when Tatas installed modern blast furnaces and began to produce at extremely low cost, and exports since that time have been shown in the following table:

## EXPORTS OF PIG IRON FROM INDIA

[In thousands of gross tons]

Year	Destination				Total exports
	Japan	United States	United Kingdom	All other countries	
1921-22	58			1	59
1922-23	112	3		3	118
1923-24	144	24	3	12	183
1924-25	171	134	19	17	341
1925-26	168	156	20	38	382
1926-27	234	40	16	19	309
1927-28	271	65	21	36	393
1928-29	353	52	5	39	449
1929-30	349	86	71	62	568
1930-31	160	108	99	72	439
1931-32	188	51	69	42	350

With Japanese purchases of Indian pig on the decrease and its future requirements apt to be largely supplied from Manchuria and Chosen, the problem of India's industry is to find dependable outlets for about 850,000 tons of pig iron, which is the estimated yearly excess of present productive capacity over requirements for local use. It is anticipated that the new duties on galvanized sheets, which give heavy preferences to sheets made in Great Britain from Indian sheet bar, will go a long way toward creating this outlet.

An analysis of the United States' import trade in pig iron from 1926 through 1932 and showing India's actual and proportionate participation is given in the following table:

## UNITED STATES IMPORTS OF PIG IRON, 1926-32

[Quantities in gross tons]

Year	From India			Total imports	
	Quantity	Value	Percent of total imports	Quantity	Value
1926	83,311	\$1,421,156	18.7	445,773	\$7,708,982
1927	66,627	1,002,070	50.3	132,658	2,254,355
1928	56,420	770,196	40.1	140,694	2,232,094
1929	69,243	956,685	46.9	147,763	2,398,498
1930	108,261	1,209,227	79.1	137,031	1,806,754
1931	67,930	695,722	80.5	84,411	978,683
1932	28,820	254,093	22.1	130,630	1,301,625

Manifestly from the foregoing the sale of Indian pig iron in the United States depends upon factors (of which price is the chief) other than the rise or fall of the American demand. In 1932, for example, both the quantity sold and the proportion of the whole trade supplied fell sharply, despite a marked upturn in total purchases. In 1931, on the other hand, receipts of Indian pig iron fell in almost exactly the same proportion as did the total trade, while in 1930 the sales of Indian pig in the United States were greater by 57 percent in the face of a 7 percent decline in total purchases.

Exports of iron and steel items of Indian manufacture other than pig iron are insignificant, amounting to about 2,000 tons in 1930-31. However, during the year 53,000 tons of scrap and old iron and steel were exported—principally to Japan for remanufacture.

### FUTURE PROSPECTS

An annual import figure in excess of 400,000,000 rupees of iron and steel and manufactures, composed principally of advanced manufactures, is indicative of the field open to the development of local manufactures to consume India's excess supply of pig iron. Apart from the products of the steel mills and their allied companies, which include rails, tin plate, shapes, galvanized sheets, rods, wire, etc., the railway shops and private engineering firms are turning out railway, plant, and various types of structural material on a fairly large scale. Shipbuilding on a small scale, and the manufacture of items such as pumps, plows, and hand implements for cultivation, sugar and rice mills, rice hullers, wagons, hand presses, and a small start in textile machinery, fans and a few other machinery lines, plus some steel furniture, shelving, lanterns, etc., comprises the principal development to date. The engineering industry has had a good start, but unfortunately has not enjoyed prosperity even during the boom years. A number of factors are involved, including duty-free imports of machinery and agricultural implements for many years, low tariffs on other competitive articles, and purely "India" problems of labor, management, and marketing.

A study of the financial position of 17 large engineering firms, whose block accounts total approximately 110,000,000 rupees from 1925 to 1931, inclusive (including their 18 share issues), indicates that 5 paid no dividends during the 7-year period; 1 paid 1 dividend of 2½ percent; 3 paid 2 dividends averaging 2½ percent; while only 1 has paid a dividend every year, and these averaged 4½ percent. The total of losses carried forward by these 17 companies was over 16,000,000 rupees. The 10-rupee shares of 7 of the companies average 3½ rupees on the exchange today. This despite the fact that 5 of the 7 years covered were considered fair years.

The past 2 years have been severely trying, and immediate prospects are no brighter; but firms that weather the present depression will be in a strong position in the market, and it is not too much to expect that when conditions again turn for the better capital will show an increasing interest and that, aided by the paternalistic tariff policy now developing, the engineering industries will show greater activity and growth.