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**THE IRON AND STEEL
INDUSTRY AND TRADE**

WITH A CHAPTER ON THE SAAR



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FOREWORD

Even before the World War the French iron and steel industry was of considerable importance. In 1913 France ranked fourth among the nations of the world in the production of both pig iron and steel, after the United States, Germany, and the United Kingdom. With the addition of the German equipment in the Lorraine and the war-time expansion of the national industry, France had advanced by 1931 to second place, after the United States, in the production of pig iron, and to third place, after the United States and Germany, in the production of steel. The real importance of the French industry, however, lies in the fact that France is a leader among those countries exporting iron and steel. In 1927 and again in 1928 its shipments in this trade exceeded those of every other nation, while in the succeeding years first place was taken by Germany.

In 1931 France produced 8,217,000 metric tons of pig iron, a decline of 21 per cent from its peak production of 10,364,000 tons accomplished in 1929. Steel production—7,809,000 tons in 1931—was also much smaller than that of 1929 (9,699,000 tons).

The French export trade in iron and steel products was at its maximum in 1927, when it reached the high figure of 5,600,000 tons. Since then the decline has been rapid, until in 1931 only an estimated 3,750,000 tons were exported. But even so, this figure was exceeded only by Germany, although the Belgian-Luxemburg total was not far behind.

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 France, and invites inquiries from interested parties relative to these industries.

JUNE, 1932.

FREDERICK M. FEIKER, *Director,*
Bureau of Foreign and Domestic Commerce.

THE FRENCH IRON AND STEEL INDUSTRY AND TRADE

WITH A CHAPTER ON THE SAAR

By Thomas Butts, American Trade Commissioner, Paris

The French iron and steel industry, through its acquisitions in Alsace-Lorraine as well as by normal growth elsewhere, has assumed an outstanding position on the Continent in the production of pig iron. In Europe it is second only to Germany in the manufacture of steel.

French iron and steel production reached its peak in 1929. In that year the average monthly output of pig iron was 864,000 tons and that of steel 808,000 tons. The decline in production was slight during 1930, but since then has accelerated somewhat, owing to the general economic depression which up to 1932 was less acute in France than in many other important industrial nations. At the end of 1931 pig-iron production was at the rate of 63 per cent and steel production at the rate of 66 per cent of the highest rate of production in 1929.

The French export trade in iron and steel products reached its zenith in 1927 and has declined rather steadily since that date. The 5,600,000 tons exported in that year made the largest total exported by any country since the 6,414,120-ton trade of the United States in 1917. France continued to hold its position as the world's leading steel exporter through 1928, when its shipments totaled approximately 4,990,000 tons, but with 1929 and in each year since its total has been exceeded by Germany and, lately, nearly equalled by Belgium-Luxemburg. Imports of these materials into France are usually quite small, reaching a peak for recent years of 425,000 tons in 1930.

RAW MATERIALS

France is the richest country in Europe from the standpoint of reserves of iron ore in place, and in the light of present knowledge of deposits it is ranked second to the United States in a world rating. With the exception of the small part which lies in Luxemburg, France controls all of the vast deposits of iron ore in Lorraine, together with fairly extensive deposits in Normandy, Brittany, and Anjou, as well as smaller deposits in 20 other Departments. In supplies of iron ore, then, the position of France is an enviable one. Coking coal, that other essential to a steel industry, however, is not available in sufficient quantities to meet the needs of the present industry; that which is at hand is, generally speaking, of rather inferior quality. Current practice calls either for the importation of coke or the mixing of domestic coking coal with imported coal to produce a fairly satisfactory if second-grade coke.

IRON ORE

Estimates of the reserves of iron ore in place in France vary considerably. Therefore, in order that relatively complete information may be had on this point, several of these estimates are given herewith for purposes of comparison.

ESTIMATES OF FRENCH RESERVES OF IRON ORES

[In millions of metric tons]

Location	Source No. 1	Source No. 2	Source No. 3	Source No. 4
Longwy.....	275	(1)	(1)	(1)
Briey.....	3, 000	(1)	(1)	(1)
Nancy.....	200	(1)	(1)	(1)
Crusnes basin.....	500	(1)	(1)	(1)
Lorraine.....	2	(1)	(1)	(1)
Total Lorraine district.....	4, 750	4, 830	4, 300	2, 373. 0
Anjou, Brittany, Normandy.....	1, 800	1, 800	1, 824	1, 930. 0
Pyrenees.....	100	100	100	49. 5
Other areas.....	(1)	100	100	17. 1
Total France proper.....	6, 650	6, 830	6, 324	4, 369. 6
North African territories.....	150	150	150	-----
Total French reserves.....	6, 800	6, 980	6, 474	-----

¹ Details not given.

² Includes deposits in Maine as well as those in Anjou, Brittany, and Normandy.

Sources:

No. 1. Research Department, Association Nationale d'Expansion Economique.

No. 2. J. Levallois, "L'Industrie du Fer."

No. 3. Henry Laufenberger, "L'Industrie Siderurgique de la Lorraine Desannexes."

No. 4. Max Roesler, "Iron Ore Resources of Europe," U. S. G. S. Bull. 706. These estimates are stated in metric tons of metallic iron, whereas sources 1, 2, and 3 are stated in tons of ore. They should be compared on this basis with other columns in this table.

The iron resources are of great variety of geological origin and composition. The richness of the workable ores also varies between wide limits—from 27 per cent in Lorraine to 62 per cent in certain deposits in the Pyrenees.

The Lorraine Basin.—The history of the iron industry in the Lorraine district dates back to the year 807, from which period until comparatively recent times, iron was taken from outcroppings extending over a distance of nearly 20 kilometers. The principal iron-ore formation lies between the Vosges and the Ardennes Mountains and runs roughly parallel to the Moselle River, between Metz and Thionville on the east and Longwy and Chambley on the west, with Nancy marking approximately the southern tip of the deposits. The total length of iron-ore deposits is about 100 kilometers (63 miles).

Before the Franco-Prussian war in 1870 the extent of the deposits was known only over a width of 8 to 9 kilometers. It was owing to this incomplete knowledge as to the width of these deposits that the Germans did not annex the Briey-Longwy district along with Alsace-Lorraine in 1871. Before 1900 numerous test holes proved the deposit over a width varying from 25 to 30 kilometers—the total extent of the Lorraine iron-ore deposits, including 4,090 hectares (9,816 acres) in Belgium-Luxemburg, being proven to underlie a

total of 120,000 hectares (296,000 acres). Of this total area, 73,000 hectares are in the Meurthe-et-Moselle Department, 43,000 hectares in Moselle, 3,600 hectares in Luxemburg, and 400 hectares in Belgium.

Workable deposits are found at various levels, known respectively as the red (upper), yellow, gray (middle), and brown and black (lower). The richest is the gray, which lies at a depth of from 200 to 250 meters and varies from 2 to 6 meters in thickness. The following analyses show the average composition of the more valuable (minette iron ore) beds in the Lorraine Basin:

CHEMICAL COMPOSITION OF THE MINETTE IRON ORE BEDS

[In per cent]

	Fe	CaO	MgO	P	SiO ₂	Al ₂ O ₃	CO ₂ H ₂ O
Red bed.....	40.4	8.2	0.5	0.7	9.6	5.5	14
Yellow bed.....	38.0	9.8	1.5	.3	7.0	4.2	-----
Gray bed.....	31.8	19.0	.5	.7	7.0	2.3	22
Brown bed.....	24.0	8.6	2.0	.6	16.6	6.5	-----
Black bed.....	39.7	5.9	.5	.7	15.1	5.2	14

Source: Roesler, Max: *The Iron Ore Resources of Europe*, U. S. G. S. Bull. 706, p. 62.

The Lorraine ores tend, generally speaking, to be silicious north of the Fentsch and south of the Orne and calcareous between those two rivers. The presence of lime in the ore, which in the Briey basin averages 10 per cent, increases fusibility and permits the greater part of the Lorrains blast furnaces to work without employing additional limestone as flux.

Surface mining is practiced in Moselle, but shafts have to be resorted to in Meurthe-et-Moselle, where, owing to the higher grade of ore produced, mining is carried out on a larger scale than in Moselle.

In 1930 extraction was at the rate of about 35,000,000 tons a year. At that rate, the known iron (Lorraine) deposits will last from 140 to 150 years—these deposits representing to-day approximately 90 per cent of the total French reserve.

Normandy and Maine, Anjou and Brittany.—In the Normandy and Maine districts, there is usually but one bed of ore. The mines of this region have long been known, but have only been worked since the beginning of the twentieth century. The extent of their present development is due in large part to the necessity of shifting of a portion of the iron and steel industry from the eastern districts during the war. The reserves in this district are estimated at about 700,000,000 tons, with one estimate (that of L. Cayeux in "Coup d'Oeil sur les Minerais de Fer de la Presqu'ile Armoricaire") going as high as 1,825,000,000 tons.

The best of the Normandy ores are those at Dielette, but these represent only a modest proportion of the total of this district. An average analysis of the ores of Normandy is contrasted with one for Dielette alone as follows:

CHEMICAL COMPOSITION OF THE NORMANDY IRON ORE BEDS

[In per cent]

Locality	Fe	SiO ₂	P	Al ₂ O ₃
Normandy (average).....	47	12	0.6-0.7	(1) ³
Dielette.....	57	12	0.25	

¹ Not given.

Source: Roesler, Max: Op. cit.

In the mines of Anjou and Brittany the ore lies in 2, 3, and sometimes 4 beds. The commonest types are red and brown hematite and carbonates, the ores containing about 50 per cent iron. The ores from the western district, owing to their comparatively low phosphorus content (0.3 to 0.75 per cent) and their high content of silica (16 per cent), are especially adapted for making foundry pig. However, they are proving such as can be handled by the basic-converter process if certain quantities of phosphated chalk are added to the charge, and although long criticized on account of their impurities, their popularity is now greatly increasing as their adaptability to various processes is being discovered.

Both surface and shaft mining are carried on in the western district. The principal difficulty is the inconstancy of thickness, pitch, continuity, and iron content of the beds. A favorable factor, however, is that the water which must be pumped to keep the shafts clear is not of great quantity.

The Pyrenees district.—About 100,000,000 tons is the estimated figure of the Pyrenees reserves. The grades of ores show great variety. They do not, as a rule, lie in beds, but in irregular formations, the geological origin of which is not well understood. They are chiefly hematites with a high iron content (50 to 55 per cent) and carbonates which are roasted locally before being shipped. They are usually silicious and relatively free from phosphorus and sulphur and have a manganese content of 3 to 4 per cent. These characteristics make them well suited to making acid Bessemer and special grades of pig iron. The special steels produced from these ores are in demand by manufacturers of war materials.

Extraction in the Pyrenees district is limited by the location of the ores, by the irregular formations referred to above, and by the lack of skilled labor available.

Other resources.—The deposits in North Africa are of good quality, but their quantity is rather uncertain, being estimated at only about 150,000,000 tons. Scattered minor iron deposits occur in various parts of France, but the mines are now of little importance except as an explanation of the existence in their neighborhood of manufacturing industries which now get their raw materials from other districts. A few companies, notably Le Creusot, continue to use some local ores, but get the greater part from elsewhere to supply their steel works. The large-scale production, made possible by the use of the basic converter in working Lorraine ores, decided the fate of these smaller, more isolated mines.

FRENCH IRON-ORE PRODUCTION

The following table shows the total amounts of iron ore produced in the various areas in France in 1913, 1928, 1929, 1930, and 1931.

PRODUCTION OF IRON ORE IN FRANCE, 1913 AND 1928-1931

[In thousands of metric tons]

District	1913 ¹	1928	1929	1930	1931
Lorraine:					
Metz-Thionville.....	21,136	20,404	21,355	20,240	15,766
Briey.....	15,104	21,155	21,366	20,563	16,862
Longwy.....	2,958	3,600	3,782	3,764	2,692
Nancy.....	1,917	1,533	1,495	1,413	1,075
Normandy and Maine	813	1,692	1,885	1,733	1,618
Anjou and Brittany	397	536	534	485	350
Pyrenees	394	193	234	161	81
Other basins	335	78	80	74	37
Total French production	43,054	49,191	50,731	48,453	38,481
Algeria	1,349	1,986	2,196	2,205	914
Tunisia	597	909	973	828	453

¹ Pre-war frontiers.

The ores produced in the Lorraine district are used by the iron and steel industry in that region, are exported to neighboring countries, and are also utilized in other parts of France where the supply is lacking or is insufficient locally.

The ores produced in the Normandy and Maine districts are used in the blast furnaces at Caen and Rouen and by the industry in the north. Those from Anjou and Brittany are used in the furnaces of Trignac (Brittany) and abroad, being frequently shipped as return cargo in the coal boats entering the ports of Nantes and St. Nazaire. The output of this latter region is at present limited, but is believed to have a promising future.

In the Pyrenees region most of the ore is taken by local furnaces and those of central France. However, some is shipped to the ports of the northern coast of France and some to Germany and Great Britain.

FRENCH IMPORT TRADE IN IRON ORE

The conditions surrounding the French import and export trade in iron ore during recent years are so abnormal as to make clear-cut deduction unsafe, but a statement of the trade in the years immediately preceding the war and in the last three years makes possible an appreciation of the more important changes which have come to affect the French iron-mining industry.

In the years immediately preceding the war France imported only a small portion of the iron ore then used—less than 1,500,000 tons. This, however, was a larger amount in proportion to domestic production than the quantity imported since the war; the chief reason for this being the transfer of the Lorraine area to French control. (Lorraine ores no longer figure among imports.) Over 800,000 tons were imported from German Lorraine in each of the years 1912 and 1913; about one-half that amount was imported from Spain (the latter ores being of very low phosphorus content), while imports from other countries were unimportant.

The following table will show the trend of imports of iron ore from the various supplying countries in the past four years as compared with 1913. It will be seen that the total in the later years is considerably less than before the war, although since 1918 the general tendency has been for imports to diminish but slightly.

FRENCH IMPORTS OF IRON ORE, 1913 AND 1928-1931

[In thousands of metric tons]

Country of origin	1913 ¹	1928	1929	1930	1931
Luxemburg.....	807	581	577	476	354
Spain.....	458	184	302	231	182
Tunisia.....		111	131	128	62
Algeria.....	53	18	27	38	68
Sweden and Norway.....	41	7	31	45	19
Other countries (Russia, Portugal, Switzerland, Belgium).....	51	88	73	94	95
Total imports.....	1,410	989	1,141	1,012	780

¹ Pre-war frontiers.

The drop in 1930 imports occurred in the last quarter of the year, whereas the monthly average until October was a little above that of 1929. The chief imports now are from that portion of the Lorraine basin lying in Luxemburg and are, therefore, of ores similar to those typical of the metallurgical industry of the east of France. Imports of Spanish ores are only about one-half of what they were in pre-war years. Receipts of Algerian and Tunisian ores, also of low phosphorous content, show a tendency to increase and are seen likely, in the future, to become of even greater importance.

FRENCH EXPORT TRADE IN IRON ORE

Exports of French iron ores in the years immediately preceding the war were about 10,000,000 tons (1913 frontiers) annually. After the war they increased steadily from that figure to a maximum of 17,000,000 tons in 1928, since which time they have tended to decrease, as is shown by the following table, which gives also the principal countries to which the ore is exported.

FRENCH EXPORTS OF IRON ORE, 1913 AND 1928-1931

[In thousands of metric tons]

Country of destination	1913 ¹	1928	1929	1930	1931
Belgium ²	5,036	12,744	12,424	11,504	10,067
Germany.....	4,065	3,194	2,668	2,403	1,574
Netherlands.....	529	930	1,126	923	703
Great Britain.....	424	172	183	151	69
Other countries.....	13	14	4	3	9
Total exports.....	10,067	17,054	16,405	14,984	12,412

¹ Pre-war frontiers.

² Including Luxemburg, except in 1913.

The principal market for exports is Belgium-Luxemburg, with Germany second. It must be remembered that shipments corresponding to those formerly made from France to German Lorraine

(Moselle) do not now, of course, appear as exports. On the other hand, supplies of ore from Moselle which go to furnaces in the Germany of to-day appear as exports from France. The purchaser next in importance after Germany is the Netherlands, which takes ore chiefly from the eastern district of France. The ore shipped to Great Britain comes chiefly from the ore beds located in the western part of the country.

FRENCH CONSUMPTION OF IRON ORE

The consumption of iron ore in the years preceding 1931, compared to 1913 (pre-war frontiers), has remained nearly steady at about 34,000,000 metric tons. Below is indicated the movement between production, imports, and exports.

DISTRIBUTION OF FRENCH IRON ORE, 1913 AND 1928-1931

[In thousands of metric tons]

Item	1913 ¹	1928	1929	1930	1931
Production.....	43,054	49,191	50,731	48,453	38,481
Imports.....	1,419	989	1,141	1,022	700
Total.....	44,464	50,180	51,872	49,465	39,181
Exports.....	10,067	17,054	16,405	14,984	12,412
Consumption.....	34,397	33,126	35,467	34,481	26,769

¹ Pre-war frontiers.

COAL

French reserves of coal are calculated at 18,000,000,000 tons, of which 10,000,000,000 are difficult to mine. There are two rich basins giving promise of long extraction—the Pas de Calais and the Lorraine. Small mines also exist in Normandy, the Lyons district, and in other parts of France, but of these most are not yet exploited.

The production of coal in France is indicated in the following table on the basis of chief producing areas.

PRODUCTION OF COAL IN FRANCE IN 1913 AND 1928-1931

[In thousands of metric tons]

District	1913 ¹	1928	1929	1930	1931
Pas de Calais.....	20,576	24,046	25,255	25,309	23,420
Nord.....	6,814	9,223	9,636	9,717	9,389
Moselle.....	3,796	5,555	6,063	6,073	5,723
Loire.....	3,777	3,716	3,778	3,672	3,126
Other regions.....	5,881	8,825	8,974	9,114	8,259
Total production.....	40,844	51,365	53,736	53,895	49,917

¹ Pre-war frontiers.

FRENCH IMPORT TRADE IN COAL

The importations of coal into France from the principal countries of origin were as follows.

IMPORTS OF COAL INTO FRANCE IN 1913 AND 1928-1931

[In thousands of metric tons]

Countries of origin	1913 ¹	1928	1929	1930	1931
Great Britain.....	11,257	8,274	13,216	13,496	10,767
Germany.....	3,491	4,510	5,148	5,101	4,616
Belgium.....	3,660	3,223	3,566	3,551	4,421
Netherlands.....	275	838	995	1,545	2,031
Poland.....		381	649	763	978
Other countries.....	19	49	83	271	58
Total imports.....	18,711	17,275	23,657	24,727	23,071

¹ Pre-war frontiers.

FRENCH EXPORT TRADE IN COAL

The exports of coal from France are but a small part, about 16 per cent in 1930, of the imports, and amounted to only 7.4 per cent of the domestic production in that year. Distribution of the exports of French coal to the principal countries of destination is set forth in the following table.

EXPORTS OF COAL FROM FRANCE IN 1913 AND 1928-1931

[In thousands of metric tons]

Countries of destination	1913 ¹	1928	1929	1930	1931
Belgium ²	811	1,562	2,113	1,302	1,035
Germany.....	8	1,496	1,330	1,831	1,192
Switzerland.....	160	1,291	1,215	911	869
Italy.....	50	398	308	453	367
Other countries.....	275	107	104	70	64
Total exports.....	1,304	4,854	5,070	4,067	3,527

¹ Pre-war frontiers.

² Including Luxemburg, except in 1913.

It should again be noted that most of the French coal is not good coking coal. In the important eastern steel-producing region a second-grade coke is made by processing local coal mixed with good coking coal imported from other districts. This subject is discussed at greater length elsewhere.

OTHER RAW MATERIALS

COKE

Coke production in France was only some 20 per cent greater in 1930 than in 1913. Figures for the early year indicate an output of 4,027,424 metric tons, this tonnage having increased by 1928 to 4,399,572 tons, by 1929 to 4,781,169 tons, and by 1930 to 5,054,812 tons. Similar figures for 1931 are not yet available, but a figure for consumption in each of these years is arrived at in the accompanying table, which also discloses the extent of both the export and import trades in this material.

FRENCH PRODUCTION, IMPORTS, EXPORTS, AND CONSUMPTION OF COKE IN 1913 AND 1928-1931

[In thousands of metric tons]

Item	1913 ¹	1928	1929	1930	1931
Production.....	4,027	4,400	4,781	5,055	(?)
Imports.....	3,070	5,368	5,451	4,565	3,396
Exports.....	2,393	3,925	3,648	2,868	1,917
Production plus imports.....	112	583	1,074	1,003	908
Exports.....	547	849	697	640	569
Other countries.....	18	6	32	54	12
Production plus imports.....	7,097	9,768	10,232	9,620	(?)
Exports.....	232	418	469	352	426
Consumption (approximate).....	6,865	9,350	9,763	9,268	(?)

¹ Pre-war frontiers.

² Figures not yet available or possible of calculation.

³ Includes Luxembourg, except in 1913.

⁴ Exports not reported on basis of countries of destination.

MANGANESE ORE

French reserves of manganese, but little of which is adapted to use in the manufacture of the grades of steel constituting the larger tonnages produced, are negligible in comparison with current consumption. It has become necessary, therefore, to supplement these ores—the greater part of which are in the Haute Pyrenees district—with extensive importation of foreign ores, chiefly Russian and British Indian, to permit the local manufacture of manganese-bearing ferro-alloys and steels. This import trade in recent years (as contrasted with 1913) has been as follows.

IMPORTS OF MANGANESE ORE INTO FRANCE IN 1913 AND FROM 1928 THROUGH 1931

[In thousands of metric tons]

Countries of origin	1913 ¹	1928	1929	1930	1931
British India.....	87	267	277	285	126
Gold Coast.....		78	103	84	35
Russia.....	137	110	184	192	138
Germany.....	1	161	84	58	31
Brazil.....	7	43	72	16	4
Union of South Africa.....			2	15	89
Other countries.....	27	92	79	61	58
Total imports.....	259	741	801	711	481

¹ Pre-war frontiers.

SCRAP

France, along with virtually every other producer of large tonnages of iron and steel, is an extensive user of scrap iron and steel. Such use at once conserves natural resources and tends to lessen production costs. In 1929, 3,458,192 tons of this one-time waste material were used. So important to the French has this material become that exportation to any country except Italy is prohibited without special license. Imports are not extensive and the industry is therefore practically dependent upon local supplies at this time.

The consumption of scrap in France in 1929 and 1930 is analyzed in the following tabulation.

CONSUMPTION OF SCRAP IRON AND STEEL IN FRANCE, BY DISTRICTS, 1929 AND 1930

[In metric tons]

Region	1929			1930		
	In pig-iron production	In steel production	Total	In pig-iron production	In steel production	Total
East.....	393,390	573,372	966,762	391,600	558,020	
Alsace-Lorraine.....	220,229	462,459	691,688	206,420	449,786	
North.....	99,396	716,134	815,530	141,296	738,677	
Center.....	41,099	469,432	510,531	45,346	439,985	
Southwest.....	8,698	45,229	53,927	17,929	47,066	
Southeast.....	20,817	117,135	137,952	31,370	124,573	
West.....	29,545	252,257	281,802	22,271	221,581	
Total.....	822,174	2,636,018	3,458,192	856,126	2,590,638	

An analysis of the foreign trade in scrap by countries is not attempted because of the small tonnage involved in the import trade, and because of the preponderance of Italy in the export trade. In 1930 imports were 28,000 metric tons and exports 309,000 tons; in 1931 imports were 34,000 tons and exports 330,000 tons.

French exports to Italy in 1930—147,163 tons—made up 47.6 per cent of the total trade. The deficiency in iron ore and scrap supplies in Italy was (and still is) so acute that provision was made in the treaty of Versailles for a guaranteed minimum of exports to that country from France, a country comparatively rich in scrap. A decree dated November 16, 1931, set the maximum of scrap exports to Italy at 250,000 tons per year—a figure well in excess of the total of 1930 shipments noted above.

FLUXING MATERIALS

The eastern iron and steel producing region, which is described above as by far the most important of the country, requires but little additional limestone and flux in the production of pig iron because the local ores are nearly wholly self-fluxing. This condition does not obtain to the same extent in the other regions. The deficiency in natural flux in the ores, other than those coming from Lorraine, is readily made up from local limestone deposits.

HISTORY AND LOCATION OF MANUFACTURE

Iron making of a primitive sort was already developed among the Celts living in what is now France in the time of Caesar. As early as 1789 there are reported to have been 1,003 iron-making establishments within the limits of France. Charcoal furnaces of small yield were used, and most of these were situated in Burgundy, Champagne, the Vosges, and the region bordering on what is now Switzerland. As a whole, the industry at that time was backward and was slow to adopt the steam engine and the puddling furnace. British engineers first taught the French, toward the end of the eighteenth century, how to make tin plate, how to improve their practice in casting cannon and making hardware, and also introduced into France the use of coke as a blast-furnace fuel.

By 1806 there were only 2 charcoal blast furnaces in England against 227 using coke. In the same year, however, only 1 coke furnace was operating in France, at Le Creusot, while as late as 1864 there were 143 furnaces out of a total of 413 in France which still used charcoal. French producers about this time were turning from iron to steel, as the producers of other countries were doing, and the industry thus entered into another phase in its development. At this point it is interesting to note that while the use of coal for smelting iron ore was adopted slowly, it was adopted rapidly by operators of forges, owing to the failing wood supply, so that by 1869 the abandonment of charcoal for forge use was practically complete.

THE DEVELOPMENT OF THE STEEL INDUSTRY

The Martin process, consisting of the use of open-hearth furnaces by which pig iron is decarbonized and the iron content increased through adding scrap iron to the charge, was responsible for a great development in the steel industry in France between 1860 and 1880. The popularity of this process has continued because of the possibility of handling, by its use, a great variety of ores and also because of the smaller size and cost of the individual open-hearth furnace.

The real impetus given to the French steel industry, however, came from the invention of the basic (Bessemer) converter. The acid Bessemer process had not been as successful in operation in France as elsewhere, owing to the impurity of the local ores, especially those of Lorraine with their high phosphorous content, and the use of this process made necessary the importation of large quantities of suitable ores from Spain, Italy, and Algeria. It was on this account (principally) that the entries of iron ore rose from 150,000 tons in 1867 to 610,000 tons in 1878.

The introduction of the Thomas-Gilchrist (basic Bessemer) process for the dephosphorization of pig iron made possible the use of the Lorraine minette, and even after the large portion of Lorraine had been taken by Germany following the Franco-Prussian war, im-

mense supplies of this raw material were left available in France for the manufacture of steel. The inventors of the new process sold their patent, literally for a song, to a Belgian, who, in turn, sold the rights to its use in France to Schneider and de Wendel for 800,000 francs, the first basic converter being set up at Le Creusot in November, 1879. In the next decade steel took the leadership over iron, but the great advance in French steel production was not to take place in the Center, where the first furnace using the new process was erected, but rather in the Lorraine Basin.

The introduction of the basic converter marks the last of the revolutionary changes introduced into French steel making. As has been mentioned above, however, the Martin open-hearth furnace was becoming increasingly popular as the industry grew in size. In the present development the open-hearth furnaces are widely scattered, owing to their adaptability and individual low cost, whereas the converters, better suited for production in larger quantities, are located mainly in the Lorraine district.

In recent years the French industry has come to use the electric furnace quite extensively for the fusion of iron ores and the manufacture of special steels. The electric steel industry is centralized in the Dauphine (Departments of Drome, Isere, and Hautes Alpes), where cheap hydroelectric power is available, contiguous to the center steel region, from which it takes the necessary raw materials.

LOCALIZATION OF THE FRENCH INDUSTRY

The present development, location, and essential localization of the French iron and steel industry is directly the result of the presence of either, or in some infrequent instances of both, fuel and iron ore. Included with those portions of the industry, the location of which was determined by the availability of fuel, are the plants located in the center and the north, while supplies of iron ore decided the location of the industries of the east and the coast districts. Besides these groups there are, of course, a number of scatter plants of minor importance, the location of which is the result of historical development rather than present-day industrial conditions.

MILLS LOCATED WITH REFERENCE TO THE FUEL SUPPLY

THE CENTER, INCLUDING THE DEPARTMENTS OF ALLIER, LOIRE, CHER, INDRÉ, NIEVRE,
SAONE-ET-LOIRE, RHONE

The production of this region in 1930 amounted to 167,000 metric tons of pig iron (1.6 per cent of the total French output of that year), 524,000 tons of raw steel (5.6 per cent of all made), and coal to the extent of 10 per cent of the national output.

The present importance of the center district of France in the iron and steel industry is due to the historical development of the industry there. Iron ore has never been available except in limited quantities, and the coal resources are not of the first order. However, around the coal mines there grew up in the period when the manufacture of iron was still more important than that of steel, groups of workmen skilled in the production of high-quality wares, even though these industries were then obliged to bring large quantities of iron

ore from other regions. The prominence of the center in tonnage production reached its maximum in 1876, when with 42 blast furnaces 402,000 tons of pig iron were produced, about one-quarter of the national yield.

The local production of raw materials grew with the introduction of British methods of manufacture, and thereafter the advance was rapid, even though the lack of easily available ores made itself felt more and more as the production of iron and steel increased. The development of the railroads lessened this disadvantage for a time, but the manufacturers in the center realized, after the discovery of new processes which made the ores of Lorraine utilizable, that they could not compete with that district without changing their policy.

Two remedies were found to maintain the existence of the industry in the center, although not to increase its importance in relation to the industry as a whole. In the first place, many of the manufacturers have set up plants on the coast, where transportation costs on high-grade foreign ores are lighter, and have acquired holdings elsewhere in France, both for the manufacture of heavy products and to supply their plants in the center with pig iron.

Second, the location of iron and steel manufacturers having become a paradox at St. Etienne and Le Creusot, where they have neither the advantage of cheap coal nor cheap ore, the basic-converter process having made competition with the eastern district impossible, the manufacturers yielded the manufacture of heavy materials to more favored regions and concentrated on the production of finished products, in the selling price of which raw materials are a less important factor than is the case with the former. At the present time the center produces only 1.6 per cent of the total French production of pig iron and 5.6 per cent of the total production of raw steel. Generally speaking, only sufficient steel is made to supply the needs of the fabricating shops. At Le Creusot, for instance, only two small blast furnaces (daily capacity, 200 tons) are operated on "imported" coal and ore, to supply the shops at Le Creusot and the various Schneider subsidiaries elsewhere. The Schneider company concentrates on the manufacture of special steels and industrial equipment of various kinds, the special steels including those used in armament, aviation, and automotive equipment.

Historically the center played the rôle of pioneer in the history of the French iron and steel industry. The first coke (blast) furnace was used at Le Creusot, and the first French fine steels were made there. In 1910 the manufacture of crucible steel was introduced there by English engineers, who 10 years later built the first French puddling furnace for refining pig in the Loire. The first Martin open-hearth furnaces were also erected in this region, and the Schneider company was the first to set up a basic converter, after the process rights had been purchased for France by Schneider and de Wendel. However, none of these inventions could save an industry which was economically misplaced. The chief interest of the plants in this district to-day is in the continuation of modern equipment and in the production of fabricated products.

THE NORTH, INCLUDING THE DEPARTMENTS OF NORD, PAS-DE-CALAIS, OISE, AND SEINE

The presence of fuel as the factor determining the location of the steel industry of the north becomes immediately apparent when it is noted that 56 per cent of the total French output of coal was mined there in 1930. Neither the output of pig iron (1,300,000 tons, 13 per cent of the total) or of crude steel (1,739,000 tons, 18.5 per cent) approach this in point of proportional importance, although this district is an important factor in the national industry. Nine-tenths of the production of iron and steel in the Nord (north) district occurs in the Nord and Pas-de-Calais Departments. The importance of Oise and Seine lies in their transforming industries.

Like the center, the north district has no rich ore beds at hand, and the ores easily reached in the mines which do exist have been nearly worked out. On the other hand, this region has abundant coal. In 1913 the local supply of fuel was still ample to fill the needs of the iron and steel industry, but since the World War the great increase in production has forced home upon manufacturers the need of assuring sources of coal and coke supplies. An increasing number of important companies have fortified and are fortifying their position by acquiring interest in coal mines and coke-oven plants, as well as by the erection of coke ovens in connection with their iron and steel plants.

The early development in this district was for the supply of raw and semifinished steel products, the raw materials for which, when not locally produced, were imported from Belgium. The characteristic feature in the years preceding the war was the existence of steel plants unattached to furnaces or of rolling mills without steel plants. This condition was a survival of the small-industry period and typical of the slowness with which the north has taken up new developments. However, it may be said that in the north, once a new process is accepted, the general adoption of the new method is as rapid as the first acceptance is slow. The first coke furnace dependent on the local coals was not set up until 1837, or some 55 years after the Schneider company had erected its coke furnace in the center, but by 1860, practically the entire industry of the region was using the coke furnace.

The Bessemer and open-hearth processes gained ground slowly in the north. The acid Bessemer process was at first preferred to the open hearth, but the abundance of scrap in the surrounding industrial area gave the latter special advantages. The invention of the basic Bessemer process, the improvement of communication with Lorraine, from which ore supplies could be easily secured, and the growing demand for soft steels later caused a shift away from the acid Bessemer method. By 1912 the production of acid Bessemer in the north was only 36,000 tons, as compared to 443,000 tons of open-hearth steel and 552,000 tons of basic Bessemer. In 1924 the production of acid Bessemer amounted to 56,975 tons, open-hearth to 462,319 tons, and basic Bessemer to 339,919 tons. In 1930 the production of open-hearth steels in the north was 806,000 tons, out of a total production of 1,739,000 tons, while the acid Bessemer production had changed little in comparison with 1924.

In the same way as for fuel, the control of iron ores has been sought by manufacturers in the north—a tendency which has been apparent for some 50 years. Either singly or in groups they have bought properties in the east, in the Longwy and Nancy districts, and they have also purchased mines in Normandy, Anjou, and Brittany. In addition, some of these makers have entered the combine controlling the mines at l'Ouenza in Algeria and also have holdings in Spain and Morocco, to assure their supplies of the high-grade ores available from these sources.

The industry of the north produces both high-grade products and the heavier products typical of the Lorraine region. The north is also the most important district in France in the manufacture of hardware. Among rolling-mill products, sheets and heavy plates are important products of the north.

MILLS LOCATED WITH REFERENCE TO THE ORE SUPPLY

The second group of iron and steel interests is that which grew up principally because of easy access to supplies of ore. This group includes the east (Meuse, Meurthe-et-Moselle, Meurthe, Haute-Marne, Haute-Saone), which is the most important of the French iron and steel districts, together with the furnaces on the coasts, which depend largely on ores imported from overseas and which are of minor importance in relation to the industry as a whole.

THE EAST, INCLUDING THE MEUSE, MEURTHE-ET-MOSELLE, MEURTHE, HAUTE-MARNE, HAUTE-SAONE

The east constitutes the background of the present French iron and steel industry. From it in 1930 came 95 per cent of the iron ore from domestic mines, 78 per cent of the domestic pig iron (7,888,000 tons), 69 per cent of the crude steel (6,456,000 tons), and 11 per cent of the national output of coal. The east also includes the mines and equipment located in the former German Lorraine, which since the war has become the French Moselle.

The extensive Lorraine resources were long considered of little importance. In the days of charcoal furnaces, surface outcroppings, not very rich nor pure, were worked; but they did not even supply the local demand for pig iron. The impure condition of the ores and the abundant wood supplies available for charcoal production delayed the introduction of new methods of manufacture. As late as 1834 there were still no coke furnaces in the east. The Marquis de Wendel was the first to introduce the use of coke (in combination with charcoal in this instance) for fuel in the east—the de Wendel interests, incidentally, occupying then as now a position of leadership in this district.

The development of railroads and canals stimulated the production of iron and revealed the possibilities of Lorraine as an iron and steel center. The mines in the northern part of Moselle (nearest to the coal regions) developed rapidly as did those close to the Sarre. From 1850 to 1869 production in the east increased almost tenfold. A similar development occurred in the Meurthe, although in this instance it was handicapped by distance from fuel supplies and the greater expense of mining the iron ore.

Before the war of 1870, the extent of the Lorraine iron ore deposits was known over a width of only 8 or 9 kilometers, and it was for this reason that the Germans did not annex the Briey-Longwy Basin along with Alsace-Lorraine in 1871. Before 1900 numerous test borings proved the deposit over a width varying from 25 to 30 kilometers and the total extent of the Lorraine iron-ore deposits, including 4,090 hectares (9,816 acres) in Luxemburg-Belgium to exceed 100,000 hectares (240,000 acres).

The outbreak of war in 1870 saw the east distinctly an iron-producing district. The Bessemer and Martin processes for producing steel had scarcely made a start locally, and the total production of the Meurthe and of Moselle by those processes was only 5,200 tons yearly. The chief product of the Lorraine region at that time was pig iron, of which 420,000 tons (30.4 per cent of the national production) were produced in 1869. The close of the war (of 1870) saw the resources and rapidly developing equipment of Moselle transferred from France to Germany, leaving, however, the Longwy and Nancy Basins to the first named. But in spite of this setback the east regained its position by 1881, when 607,000 tons of pig iron were produced (32 per cent of the national production).

At this point the invention of the Thomas-Gilchrist process and the purchase of the patents for France by a group including the de Wendel interests modified the whole trend of the industry in the east. As soon as the patent rights expired other companies immediately began to use the process, and Lorraine ore no longer found its chief outlet in pig iron for castings but in the manufacture of basic steels and to a lesser degree open-hearth steel. In 1913 the production of basic Bessemer steel in the east was 4,309,000 tons out of a total production of steel in that region of 4,800,000 tons. Out of the 1930 total production of the east, namely, 6,456,000 tons, 5,406,000 tons were basic Bessemer, and 1,023,000 tons were open-hearth steel, while of the 1931 production of 5,355,000 tons, 4,432,000 tons were basic Bessemer and 878,000 tons were open-hearth steel.

The increased capacity of the French steel industry since the war is strikingly apparent when one realizes that 70 per cent of the present Lorraine production (capacity) was in the hands of Germany until 1919. Although the total Lorraine production has declined somewhat under the French, the Germans have more than made up for their loss of this territory by extending their mills in the Ruhr and importing Swedish ore.

The industry in the east has conspicuous points of strength and of weakness. Chief among the first is that it has added to its command of ores a unity of manufacturing processes not found elsewhere in France. In the larger organizations blast furnaces and steel mills are regularly under the same management; thus the gases of the blast furnaces can be made to furnish power for working the steel, an economy which can not be practiced in the north, for instance, where furnaces and steel mills are usually separated both in location and management. The few furnaces in the east which do not have steel mills are, generally, those which supply pig to steel mills owned elsewhere by the same interest. However, the east is almost as weak in fuel resources as it is strong in ore supply. As Longwy the iron and coal mines are only a few miles apart, and

elsewhere, in the Saar district particularly, rich coal mines are being exploited. Unfortunately, however, the Lorraine coal is not in itself good coking coal, although second-grade coke is being made by processing locally mined coal and mixing it with good coking coal imported from other districts. At this time the important de Wendel interests as well as some other large firms in Lorraine operate their own coke-oven plants, but recently, however, the strictly coal-mining companies, alarmed by the increasing tendency of the steel mills to produce their own coke, have made extensive price reductions on their coke in an effort to keep this business because of the profit to be made from the sale of by-products.

The five steel mills around Longwy have formed a cooperative company for the making of coke to insure them of a regular supply at a reasonable price. The various companies participate in the cooperative organization in proportion to the size of their coke requirements, and operate the ovens located at Sluiskil, on the river Scheldt, in the Netherlands. This location is such that good coking coal may be purchased, with short haul, in either England, Netherlands, Germany (Ruhr), or Belgium. Further, considerable savings can be effected by taking advantage of differences in the price of coal, as market conditions vary in the countries mentioned. Manufacturers in the Lorraine district also have large holdings in foreign coal mines, but the capital invested in this way has considerably decreased since the war on account of political difficulties. (French capital invested in Belgian coal mines before the war is estimated to have reached between 60,000,000 and 80,000,000 francs.) The 1930 production of coal in Lorraine itself, it may be mentioned, was nearly double that of 1913, and in 1931, 5,723,000 tons of coal were mined.

At present the chief products of the east include railway equipment and heavy profiles, bars, and other bulky soft-steel goods. The greater part of the remainder of the soft steel is sold in the form of ingots, blooms, and billets to the transformers of the north and center. The present tendency in the east, however, is toward a greater interest in finished products, continuing the tendency toward vertical rather than horizontal development on the part of the manufacturers.

Contrary to their policy in the past, the steel mills in the east of France are making a determined effort to produce more special steels. Most of them have installed open-hearth furnaces for the production of high-quality products such as rails in chrome-nickel steel, as well as up-to-date electric steel plants. Four large companies—the Société Lorraine Minière et Métallurgique, the Union de Consommateurs de Produits Métallurgiques et Industriels, Forges et Acières de Nord et Lorraine, and the Société d'Electro-Chimie d'Ugine—have recently formed subsidiaries for the purpose of constructing special plants and specializing therein in the production of electric steel. The first two companies named above have formed a subsidiary which is known as the Société des Acières Fins de l'Est, which is currently engaged in constructing among other units, a 25-ton electric furnace, while the latter two have formed the Société des Aciéries Electriques d'Ugine et d'Uckange. The formation of two further companies to operate in the Longwy Basin with 15-ton electric furnaces is projected.

SECONDARY AND COASTAL PLANTS

As has already been stated, the center, north, and east of France produce together about 90 per cent of the total French production of pig iron. The remainder of the production comes from plants located either on the coast or scattered over the country. Generally speaking, the coastal plants, which are located with a view to easy access to local or imported ore and which depend largely on British coal, concentrate on the production of special grades of pig iron and on spiegeleisen, ferro-alloys including ferrosilicon, etc. Most of these plants were constructed at a time when the future was believed to lie in the production of acid Bessemer steel, so that the invention of the basic Bessemer process resulted in the failure of many of them. Most of those which weathered the storm turned to the production of alloy pig iron, adapting their equipment to the use of phosphorus ores. The best situated of the furnaces in this group are those at Caen, whose chief purpose is to exploit local ores with British and German coal. They produce about equal amounts of basic and open-hearth steel, and with the other coastal plants make up about 7 per cent of the total French steel production.

The existence of the secondary plants situated at some distance from the iron and steel producing regions may be explained in general by the fact that they are either a survival of the period of purely localized production or by their proximity to industries which demand easy access to some iron or steel specialty. The more important secondary plants are located in the Ardennes and Haute-Marne, the principal products of which are small specialties, such as bolts, nails, etc., and from one furnace in the Haute-Marne high-grade goods, chains, metal beds, agricultural implements, and other finished products. The survival of these secondary plants is due in some measure also to the fact that they are considered a valuable asset from the point of view of national security in view of the extremely vulnerable position of the industry in the east, which was so emphatically revealed in the last war, when, six weeks from the outbreak of hostilities, 19 per cent of the pig-iron producing capacity was in the hands of the Germans and 62 per cent in the zone of martial operations.

FRENCH PRODUCTION

In the succeeding pages the production of pig iron, ferro-alloys, and crude and finished steel will be analyzed on a number of bases, including a more detailed breakdown by producing areas than has heretofore been employed in this study of the French iron and steel industry. It is necessary therefore to list the several Departments included (officially) by the Comité des Forges de France in its statistical analyses of production, in order that no confusion may arise as to the exact territory embraced by each specified geographical division. The Departments included in the respective areas are as follows:

East.—Ardennes, Aube, Belfort, Doubs, Jura, Haute-Marne, Haute-Saone, Marne, Meurthe-et-Moselle, Meuse, and Vosges.

Alsace-Lorraine.—Moselle, Bas-Rhin, and Haut-Rhin.

North.—Aisne, Nord, Oise, Pas-de-Calais, Seine, Seine-et-Marne, Seine-et-Oise, and Somme.

Center.—Allier, Ardeche, Cantal, Cher, Correze, Cote d'Or, Creuse, Haute-Loire, Haute-Vienne, Indre, Loire, Loiret, Lozere, Nièvre, Puy-de-Dome, Rhone, Saone-et-Loire, and Yonne.

Southwest.—Ariege, Aude, Aveyron, Basses-Pyrenees, Charente, Dordogne, Gers, Gironde, Haute-Garonne, Hautes-Pyrenees, Landes, Lot, Lot-et-Garonne, Pyrenees-Orientales, Tarn, and Tarn-et-Garonne.

Southeast.—Ain, Alpes-Maritimes, Basses-Alpes, Bouches-du-Rhone, Drome, Gard, Hautes-Alpes, Haute Savoie, Herault, Isere, Savoie, Var, and Vaucluse.

West.—Calvados, Charente-Inferieure, Cotes-du-Nord, Deux-Sevres, Eure, Eure-et-Loire, Ile-et-Vilaine, Indre-et-Loire, Finistere, Loire-et-Cher, Loire-Inferieure, Maine-et-Loire, Manche, Morbihan, Orne, Sarthe, Seine-Inferieure, Vendee, and Vienne.

PIG IRON

The growth of the iron and steel industry in France, as in other countries, has been made possible through technical developments which have brought about a revolution in the physical equipment employed. The introduction of larger units of manufacture, the development of better communication systems, and the great growth in the outlets for iron and steel products have brought about a transformation of the industry, one of the outstanding characteristics of which has been the practically complete abandonment of former producing practices and the integration of operations in the hands of a comparatively few companies. This latter development is still far from complete, but it already furnishes a strong contrast to conditions previously obtaining.

In 1819 the use of mineral fuel in the siderurgical industry in France, except at Creusot, was practically unknown. The number of furnaces was steadily growing—it was already 350—but the Meurthe-et-Moselle districts, now the leaders in French production, had relatively little importance. As late as 1856 there were only 44 furnaces there in a total of 591, the greatest number of furnaces recorded at work in France since the days when iron making was based entirely on scattered charcoal furnaces. Already the shift to mineral fuel was under way, and over a fourth of the existing fur-

naces had by this time abandoned vegetable fuels. After that date the progress toward mineral fuels was steady and their use is now practically complete. Only 10 charcoal furnaces were operating in 1901, only 2 in 1913, since which time this industry has continued with totals of no importance.

Over this period the number of furnaces using coke also declined, although their average size was growing. This reduction continued until in 1894; in 1895 there were only 99 blast furnaces in France, but after these years the number of furnaces increased, while the importance of the individual manufacturing units continued to rise. By January 1, 1913, the total of blast furnaces in France reached 226.

The World War destroyed a portion of the equipment of the industry and further emphasized the tendency it had shown to group itself in large units. At the same time it added to the national equipment that of Alsace-Lorraine. As a result of these developments in opposite directions, on November 1, 1931, there were in France (with Alsace-Lorraine) a total of 212 blast furnaces, of which 65 were in the area restored to France as a result of the war.

BLAST-FURNACE EQUIPMENT

The changes in blast-furnace equipment and its utilization from 1913 to November 1, 1931, are given below.

NUMBER OF BLAST FURNACES IN FRANCE, AT END OF YEAR INDICATED ¹

Region	Active			In repair and idle			Dismantled ²		In construction ³	
	1913 ⁴	1929	1930	1913 ⁴	1929	1930	1929	1930	1929	1930
East.....	77	66	62	23	14	19	2	2	6	4
Alsace-Lorraine.....		50	42		8	18	3	2	4	3
North.....	23	16	16	1	3	4	2	0	1	1
Center.....	7	6	4	4		2	1	0	1	1
Southwest.....	13	8	6		7	10	3	3	0	1
Southeast.....	6	3	3	3	3	2			0	0
West.....	3	5	4	0	4	4			0	0
Total.....	129	154	137	35	39	59	11	7	12	10

¹ On Oct. 31, 1931, 103 blast furnaces were in operation and 109 were idle. On Dec. 31, 1931, 90 were operating, 120 were idle.

² Pre-war frontiers.

³ Figures for 1913 not available.

The blast furnaces of the east and Alsace-Lorraine regions—which are the backbone of the French iron and steel industry of to-day—are, as a rule, well laid out for the production of basic pig iron from the local ores. Many of the producing companies own iron mines, hold them under lease, or are affiliated with the owners of the mines so that in the eastern district more than one-half of the ore delivered is from mines owned by the operators or by their affiliations. In some cases the works are located at the mine site, while in practically all instances the mines and furnaces are close together.

Generally basic steel works are operated in connection with the furnaces, the power for running the equipment being obtained from the blast-furnace gas. Where this is not the case, the surplus gas is frequently used for public utilities as notably at Metz and Lille.

GROWTH OF PIG-IRON PRODUCTION

The following table indicates the steady growth of pig-iron production in France and the important part which has come to be played therein by the leading districts—the Department of Meurthe-et-Moselle and, since the war, the returned area of Alsace-Lorraine.

GROWTH OF PIG IRON PRODUCTION IN FRANCE, 1819-1931

[In thousands of metric tons]

Year	Meurthe-et-Moselle	Alsace-Lorraine ¹	All of France ²	Year	Meurthe-et-Moselle	Alsace-Lorraine ¹	All of France ²
1819.....	(a)	(a)	112	1913.....	3,499	3,862	5,311
1825.....	(a)	(a)	198	1914.....	(a)	2,392	2,690
1830.....	(a)	(a)	225	1915.....	(a)	1,819	586
1835.....	14	(a)	294	1916.....	(a)	2,061	1,489
1840.....	23	(a)	405	1917.....	(a)	2,620	1,735
1845.....	26	(a)	498	1918.....	(a)	1,796	1,306
1850.....	36	(a)	405	1919.....	305	1,112	2,412
1855.....	72	(a)	849	1920.....	1,075	1,367	3,434
1860.....	102	(a)	898	1921.....	1,036	1,447	3,416
1865.....	240	(a)	1,203	1922.....	2,065	2,260	5,228
1870.....	307	(a)	1,178	1923.....	2,140	1,895	5,431
1875.....	299	(a)	1,448	1924.....	3,052	2,964	7,693
1880.....	538	(a)	1,725	1925.....	(a)	(a)	8,472
1885.....	706	430	1,630	1926.....	(a)	(a)	9,393
1890.....	1,084	640	1,962	1927.....	(a)	(a)	9,298
1895.....	1,254	829	2,003	1928.....	4,185	3,634	9,961
1900.....	1,669	1,524	2,714	1929.....	4,313	3,503	10,364
1905.....	2,116	2,169	3,076	1930.....	4,312	3,512	10,035
1910.....	2,756	2,723	4,088	1931.....	3,578	2,812	8,217
1912.....	3,403	3,019	4,939				

¹ German territory between 1870 and 1919, when it was returned to France.

² Within existing boundaries obtaining in each year specified.

³ Information not available.

⁴ No record of production in these years, territory being in zone of operations of the World War.

The east continues to be by far the principal pig-iron producing region of France, although its percentage of total production decreased from 81.8 per cent in 1913 to 77.8 per cent in 1931. The north and west regions show increases in relative importance.

FRENCH PRODUCTION OF PIG IRON, BY REGIONS

[In thousands of metric tons]

Region	1913 ¹	1928	1929	1930	1931	Percentage	
						1913	1931
Meurthe-et-Moselle, Haute-Marne, Ardennes.....	3,560	4,185	4,313	4,312	3,578	39.2	43.6
Moselle.....	3,864	3,634	3,806	3,512	2,812	42.6	34.2
North.....	933	1,165	1,215	1,301	1,096	10.3	13.4
Center.....	184	209	189	167	119	2.0	1.4
Southwest.....	261	142	175	177	129	2.9	1.6
Southeast.....	160	140	139	159	96	1.8	1.2
West.....	109	506	527	407	385	1.2	4.6
Total production.....	9,071	9,981	10,364	10,035	8,217	100.0	100.0

¹ Pre-war frontiers.

PRODUCTION OF PIG IRON BY CLASSES

The production of pig iron in the same years is shown below by classes, or quality, of the product.

FRENCH PRODUCTION OF PIG IRON, BY CLASSES

[In thousands of metric tons]

Classes	1913 ¹	1928	1929	1930	1931	Percentage	
						1913	1931
Phosphorus:							
Basic Bessemer.....	6,624	7,780	7,979	7,677	6,360	78.7	77.5
Foundry.....		1,168	1,248	1,228	954	12.2	11.6
Puddling.....		19	10	4	11		
Semiphosphorus.....	1,710	137	164	152	127	1.5	1.6
Hematite:							
Foundry.....		338	369	365	289	3.6	3.5
Bessemer and puddling.....	656	328	360	372	297	3.7	3.6
Spiegel iron and ferroalloys.....	81	211	234	237	179	2.3	2.2
Total production.....	9,071	9,981	10,364	10,035	8,217	100.0	100.0

¹ Pre-war frontiers.

Since pig for puddling and foundry pig may be either phosphorus or hematite, this classification does not indicate fully the character of the French product. The outstanding French pig iron is now, as before the war, high in phosphorus, nearly nine-tenths of the total being of this character. Hematite pig has in recent years held a fairly steady relation to the total production and constitutes all but a small portion of the balance.

In 1930, 90.5 per cent of the total pig-iron production was phosphorus, 7.3 per cent was hematite, and 2.2 per cent was special pig iron. In 1931 the proportions were 90.7 per cent, 7.1 per cent, and 2.2 per cent, respectively.

Phosphorus pig iron.—Phosphorus pig iron (containing more than 1 per cent of phosphorus) is the characteristic production of the great producing regions of the north, east, and Alsace-Lorraine. These districts in 1930 produced 91 per cent of the total pig iron of France, and of the production of these districts over 88.8 per cent was phosphorus pig iron.

PRODUCTION OF PHOSPHORUS PIG IRON IN 1929 AND 1930, BY GRADES AND REGIONS

[In metric tons]

Class and region	1929	1930	1931
Basic Bessemer pig:			
East.....	3,492,810	3,468,712	
Alsace-Lorraine.....	3,163,147	2,892,461	
North and west.....	1,322,962	1,315,639	
Total.....	7,978,919	7,676,812	6,360,000
Phosphorus foundry pig:			
East.....	715,915	740,631	
Alsace-Lorraine, north, and west.....	532,239	487,208	
Total.....	1,248,154	1,227,839	954,000
Pig free from manganese: East and Alsace-Lorraine.....	10,422	4,439	11,000
Grand total.....	9,237,495	8,909,090	7,325,000
Per cent of total production of pig (all qualities).....	89.1	88.8	89.0

Hematite pig iron.—The centers for production of hematite pig (containing less than 1.12 per cent of phosphorus) in France are less localized than in the case of phosphorus pig, as is indicated in the following table.

PRODUCTION OF HEMATITE PIG IRON IN 1929 AND 1930, BY GRADES AND REGIONS

[In metric tons]

Class and region	1929	1930
Acid and basic open-hearth puddling pig:		
North.....	107,315	122,510
Center.....	70,965	
Southwest.....	45,672	98,827
Other regions.....	122,639	133,773
Total.....	346,591	355,110
Foundry pig:		
Center.....	87,070	79,644
North.....	75,686	67,969
Southwest.....	81,347	110,136
Other regions.....	125,233	106,811
Total.....	369,336	364,560
Bessemer pig, total.....	12,775	16,747
Grand total.....	728,702	736,417
Per cent of total production of pig (all qualities).....	7.0	7.3

The 1931 production of hematite pig iron was 586,000 tons. Statistics of the production by regions are not yet available. The east produces no hematite pig iron. The production of that particular quality of pig (containing less than 0.12 per cent of phosphorus) is more or less evenly distributed over the other producing regions, although the north accounts for nearly one-third of the total output. The center leads in the production of hematite foundry pig.

Semiphosphorus pig iron.—The production of semiphosphorus pig iron in France for the years 1929 and 1930 is given below.

PRODUCTION OF SEMIPHOSPHORUS PIG IRON, BY GRADES AND REGIONS, IN 1929 AND 1930, CONTAINING FROM 0.12 TO 1 PER CENT OF PHOSPHORUS

[In metric tons]

Class and region	1929	1930
Semiphosphorus foundry pig:		
Alsace-Lorraine.....	(¹)	69,249
Other regions.....	(¹)	44,174
Total.....	(¹)	113,423
Basic open-hearth semiphosphorus puddling pig: North, west, and center, total.....	(¹)	33,588
Grand total.....	163,854	152,011
Per cent of total production of pig iron (all qualities).....	1.6	1.5

¹ Previous to 1930 the production of semiphosphorus pig iron was not classified by regions.

The 1931 production of semiphosphorus pig iron amounted to 127,000 tons (statistics of the production by regions are not yet available). The Alsace-Lorraine producing region accounted for

61 per cent of the production in 1930. Basic open-hearth semi-phosphorus pig iron is produced solely in the north, west, and center regions.

Slag.—The grinding (and sale) of the slag resulting from the basic pig iron made in the east and Lorraine results in a by-product highly profitable to blast-furnace operators in these regions. The ground slag finds widespread employment as fertilizer on account of its relatively heavy content (17 to 25 per cent) of phosphoric acid.

Spiegel iron and ferro-alloys.—The production of spiegel iron and ferro-alloys in the years 1929 and 1930 was as follows.

FRENCH PRODUCTION OF FERRO-ALLOYS IN 1929 AND 1930

[In metric tons]

Class and region	1929	1930
Spiegel iron:		
East, Alsace-Lorraine, and north.....	70, 076	59, 993
Other regions.....	40, 722	39, 489
Total.....	110, 798	99, 482
Ferromanganese, total.....	74, 762	77, 354
Ferrosilicon:		
Southeast.....	26, 019	30, 327
Southwest and center.....	10, 313	13, 800
Total.....	36, 332	44, 127
Other ferro-alloys, ¹ total.....	11, 813	16, 617
Grand total.....	233, 705	237, 580
Per cent of total production of pig iron (all qualities).....	2.3	2.4

¹ Silicomanganese, ferrochrome, ferromolybdenum, ferrotungsten, etc.

The total production of spiegel iron and ferro-alloys decreased from 237,580 tons in 1930 to 179,000 tons in 1931. Detailed statistics of the production in 1931 by regions were not yet available at the time of publication. Spiegel-iron production is fairly evenly distributed over all producing regions, while the production of the ferro-alloys is confined exclusively to the southeast, southwest, and center regions, where cheap hydroelectric power is available.

ELECTRIC-FURNACE EQUIPMENT

The presence of relatively cheap hydroelectric power in southern and, to a lesser extent, central France resulted in the development of a fairly extensive electric-furnace industry in those areas even before the war. Although the size of most units was small, there were (in the southwest) 76 electric furnaces on January 1, 1913, which number had increased to 138 by 1929. At the close of that year there were 68 electric furnaces in operation; 64 were in repair or idle. Five furnaces of obsolete construction had been dismantled, while one new furnace was under construction. The dismantling of obsolete furnaces was apparently continued in 1930, for, as of December 31 of that year, 67 electric furnaces were reported in operation, 60 were idle, while 3 were under construction.

STEEL

With the shift from the use of iron to that of steel the French iron and steel industry has shown a development similar to that which has occurred in other great producing countries. As a result, all but a minor portion of the pig iron now produced ultimately finds its way into the production of raw steel and finished products. Information collected by the Comité des Forges shows that, while the production of pig iron in France was 10,035,000 tons in 1930, there were produced 9,447,000 tons of steel ingots and steel castings during the same year. This figure compares with a total of 4,686,866 tons of steel produced in France in 1913 without Alsace-Lorraine, or an increase of 4,761,000 tons over that year. In 1931 the total steel production decreased to 7,809,000 tons.

This favorable showing makes a strong contrast with that of 1923, when the interruption of coal shipments from the Ruhr Basin severely cut down the production of iron and steel in France, particularly in the east and Alsace-Lorraine. The extent of recovery, even under adverse conditions, furnishes a contradiction to the contention that the Alsace-Lorraine industry would not be efficiently organized and operated under French control.

FRENCH STEEL PRODUCTION BY NATURE OF PRODUCT

[In thousands of metric tons]

Product	1913 ¹	1928	1929	1930	1931
Ingots.....	5,886	9,292	9,462	9,175	7,568
Castings.....	87	208	237	272	241
Total production.....	5,973	9,500	9,699	9,447	7,809

¹ Pre-war frontiers.

In 1913, 1.2 per cent of the total steel production was made into castings; in 1931 castings accounted for 3.1 per cent of the total.

The greatest advance in 1930, as compared with 1913, was in the production of basic Bessemer steel—an increase of 1,662,000 metric tons—the production of open-hearth steel increasing 835,000 tons in the same period. In the east alone (within the pre-war frontiers) the increase in total production from 1913 to 1930 was 1,114,000 metric tons or 44 per cent; in the north steel made a gain of 50 per cent in the same period, to 1,732,000 tons. In the center the output declined 1.5 per cent to 522,000 tons. Production between 1913 and 1930 increased 164 per cent in the west (to 495,000 tons); in the southeast it gained 12 per cent (to 135,000 tons); but in the southwest steel production declined 60 per cent to only 61,000 tons in 1930.

The above comparison of the production of steel ingots and castings in 1913 with 1930 indicates the trend of development in the various producing regions. In 1913, when Alsace-Lorraine was still under German control, the eastern region produced over one-half of the national yield of steel ingots and steel castings, while the north produced over one-fourth, the balance of the production being scattered over the other four minor producing regions. In 1930 the

percentage of production in the east (proper) had fallen to 38.5 per cent—this decline in percentage being due, of course, to the addition to the national total of the production of Alsace-Lorraine, which practically duplicated the amount contributed by the pre-war east. In 1930 the north produced 18.3 per cent of the total, the yield showing an increase in actual tonnage of 555,000 tons. The center produced about the same amount in both years, but declined on the basis of the percentage contributed, owing to the addition of Alsace-Lorraine.

PRODUCTION OF STEEL IN FRANCE, BY REGIONS

[In thousands of metric tons]

Region	1913 ¹	1928	1929	1930	1931
East ²	2,514	3,630	3,674	3,628	3,017
Alsace-Lorraine.....	2,286	2,967	2,985	2,874	2,338
North.....	1,177	1,605	1,698	1,732	1,449
Center.....	530	532	566	522	389
Southwest.....	159	63	56	61	62
Southeast.....	120	124	125	135	63
West.....	187	579	595	495	491
Total production.....	6,973	9,500	9,699	9,447	7,809

¹ Pre-war frontiers.

² Meurthe-et-Moselle, Haute-Marne, Ardennes, Belfort, Doubs.

A review of the processes used in the production of steel ingots and castings shows comparatively little change in the percentages produced by the basic Bessemer and open-hearth methods between the prewar output and that of 1930. Production by the basic Bessemer process amounted to 70 per cent in 1913 and to 69.5 per cent in 1930. In volume the production of open-hearth steel registered an increase of over 50 per cent between 1913 and 1930. Every district of the country except the north sharing in this increase. The production of this quality steel is limited in large part by the supply of scrap available.

Other methods of producing steel do not contribute important percentages to the total yield in France. In 1930 the basic Bessemer and open-hearth processes together made up 97 per cent of the national total. Acid Bessemer production declined from 253,000 tons in 1913 to 117,000 tons in 1930, and Alsace-Lorraine, the southeast, and the southwest contributed no acid Bessemer steel in the latter year. The totals for acid Bessemer were less in 1930 than in 1923 in every region of France except the north and the center, where slight increases occurred.

Crucible steel production has fluctuated from 24,085 tons in 1915 (including Alsace-Lorraine) to 17,000 tons in 1929, to 10,000 tons in 1930, and to 12,000 in 1931, when steel production generally declined. Nearly the whole of the crucible steel production comes from the center.

Crucible steel manufacture is steadily yielding to electric-furnace production, however. Twenty-seven thousand tons of electric steel were produced in France (excluding Alsace-Lorraine) in 1913, while in 1930 the total production was 154,000 tons. In 1931, when total steel production was nearly 7 per cent less than in 1930, electric steel production was slightly higher at 156,000 tons.

The center of electric steel production in 1913 was the southeast, though smaller amounts were then produced in the southwest and in the center. In 1930 the southeast manufactured more than one-half of the total national yield and the center more than one-third. Alsace-Lorraine produces no electric steel.

FRENCH STEEL PRODUCTION BY METHOD OF MANUFACTURE

[In thousands of metric tons]

Method	1913 ¹	1928	1929	1930	1931
Basic Bessemer.....	4, 907	6, 586	6, 680	6, 569	5, 453
Open-hearth.....	1, 762	2, 689	2, 753	2, 597	2, 090
Electric.....	27	128	151	154	156
Acid Bessemer.....	253	81	98	117	98
Crucible.....	24	16	17	10	12
Total production.....	6, 973	9, 500	9, 699	9, 447	7, 809

¹ Pre-war frontiers.

Basic Bessemer (Thomas) steel leads all others in the amount produced, because the pig made in the eastern producing region is very rich in phosphorus (best refined in a basic converter), and to a lesser degree because scrap is comparatively scarce in France. Of the total steel production in 1931, 69 per cent was basic Bessemer.

PRODUCTION OF SEMIFINISHED PRODUCTS

French production of semifinished products has declined steadily since 1928—a circumstance traceable to reduced foreign sale and to the increasing tendency for the larger producers of this heavy material to engage in the manufacture of more highly finished products. In 1928 the domestic output of these semiproducts (chiefly ingots, blooms, billets, slabs, etc.) is stated to have been 1,957,000 metric tons, declining to 1,757,000 tons in 1929, to 1,584,000 tons in 1930, and to 1,329,000 tons in 1931.

In 1930 about 40 per cent of the production of semifinished products was exported, mostly to Belgium, Great Britain, Italy, and Germany. In 1931 the proportion was about the same. In that year England took 168,000 tons (compared to 119,000 tons in 1930); Belgium purchased 119,100 tons in 1931 or nearly 50 per cent less than her purchases in 1930 (which amounted to 233,000 tons). Likewise Italy's imports of French semifinished steel products declined greatly, from 127,600 tons in 1930 to 79,200 tons in 1931.

PRODUCTION OF FINISHED PRODUCTS

A comparison of the statistics given in the following table with the total steel production figures in 1913 and 1931 indicates the extent to which France is becoming industrialized. From 1913 to 1931 French steel production increased 12 per cent (from 6,973,000 to 7,809,000 tons.) In those same years the increase in the manufacture of finished steel products was 24 per cent (4,368,000 tons in 1913 to 5,408,000 tons in 1931) or proportionately twice as great an increase as that in the production of the raw unmanufactured products.

FRENCH PRODUCTION OF FINISHED PRODUCTS

[In thousands of metric tons]

Products	1913 ¹	1928	1929	1930	1931
Bands.....	92	79	79	85	56
Axles and forgings.....	87	73	76	91	74
Rails.....	698	537	610	582	392
Ties.....		141	142	194	116
Frogs, switches, fishplates.....		46	45	59	33
Beams.....	854	838	878	771	732
Wire rod.....	275	445	435	354	290
Wire.....	72	157	190	177	167
Sheets.....	(²)	257	258	226	218
Semifinished products for making pipe ³	(²)	93	108	71	54
Pipe.....	62	238	260	208	150
Special bar steel.....	1,520	172	207	189	154
Merchant shapes.....		2,199	2,279	2,276	1,927
Tin plate.....	39	80	86	90	90
Sheets less than 5 mm.....	669	754	819	743	585
Sheets 5 mm and above.....		379	366	377	310
Flats.....		62	73	82	60
Total.....	4,368	6,553	6,911	6,575	5,406

¹ Pre-war frontiers.² Not known.³ Blooms, billets, and rounds.

Tin plate is the only item which did not show a decrease in production from 1930 to 1931, output remaining virtually stationary in the two years. The largest important decrease (33 per cent from 1930 to 1931) was in rails. The decline is accounted for partly to a decrease of about 10 per cent in exports, but largely to the difficult financial position of the railways, which restricted equipment purchases in 1931 to minimum requirements.

LABOR, WAGES, AND PRICES

Working conditions have changed so rapidly in the French iron and steel industry that comparisons of present and pre-war years are difficult. The 8-hour day has appreciably modified working conditions and costs, and the increasing nominal wage rates have been in varying measure accompanied by rising living costs. Reorganization of the production units and improvements in machinery and processes have affected the capacity of the industry and the output per man. Finally, the unsettled conditions in international trade and the confusion and interruption of sources of supply of raw material, owing to political developments, have made operations abnormal and the calculation of comparative labor costs difficult. Any conclusion based on statistics alone is, therefore, subject to reservations.

In the Longwy district, the average daily wage in June, 1931, was slightly more than six times what it was in 1914. Before the war the average daily wage of a blast-furnace hand had been 5.25 francs¹ per 12-hour shift. The present wage is 32 francs for an 8-hour shift; hence the cost per day in 1914 was 5.25 multiplied by 2 shifts, or 10.5 francs per 24 hours, as compared to 32 multiplied by

¹ The franc par of exchange was \$0.193 in 1913; since 1926 it has been \$0.039 in U. S. currency.

3 shifts, or 96 francs in 1931. The increase therefore is more than 900 per cent, while the general price index has declined steadily since May, 1931, when it was at 494 (1913=100); it had dropped to 413 at the beginning of 1932. It is seen that the factor of labor in pig-iron production costs has increased more than twice as much as other costs, although in 1930 a yield of 350.6 tons of pig iron per workman was attained. In 1913 the average yield per workman in the steel-making branch of the industry was 66 tons, but by 1930 the steel production per workman had increased to about 73.2 tons.

In iron-ore mining in 1913 the average daily wage was 7.12 francs for underground workers and 4.96 francs for laborers above ground, the average for both classes being 6.36 francs and the annual production of iron ore suitable for reduction was 859 metric tons per man. (In 1913 in the area then under German control the extraction of ore was about 999 metric tons per man.) In 1930 the extraction in the Lorraine field was at the rate of 1,275 metric tons per year per man. The nominal wage of the French iron-ore miner rose fairly steadily throughout the war period and has continued its upward course since that time. There are great variations in the different districts in which the mines lie, but the lower wages, where they obtain, do not indicate a corresponding advantage in cost of operation for the producers, since as a rule the advantage of low-priced labor is found only in districts where other operating costs are higher.

The proportion of foreign workers in the iron and steel industry (chiefly Polish and Italian) varies according to the season and the plant. The French workers in the Longwy basin (which is representative) represent 45 per cent of the 1914 total—not taking into account the clerical and executive staffs, which were then and still are exclusively French. In 1929 and early in 1930 the proportion of French manual laborers had fallen to 30 per cent because of the impossibility of obtaining local labor during that period of acute labor shortage.

WAGES AND COST OF LIVING

None of the available figures as to nominal wages gives a fair estimate of the comparative economic position of the workman in the French iron and steel industry in years before the war as compared to the present time. The variations in the gold value of the franc and the variations in the cost of living for the country as a whole, and for the various districts lessen the value of generalizations.

Comparisons of the gold value of the wages received before the war and at present do not give a fair measure of the course of development for the reason that the price indices for the cost of living do not follow these fluctuations sufficiently close. Comparisons with the percentages of increase or decrease of wages in other countries, after the nominal wage is reduced to a gold basis in each case, are also unsafe for the same reason.

The unweighted general index of wholesale prices in France stood at 413 in December, 1931, as compared with monthly averages of 623 in 1929 and 543 in 1930. The following table gives the details of the

unweighted wholesale prices for December, 1931, together with the monthly averages for 1929 and 1930:

UNWEIGHTED WHOLESALE PRICE INDICES IN FRANCE

[Based on 100 in July, 1914]

Item	Number of articles	Monthly averages		December, 1931
		1929	1930	
General index.....	45	623	543	413
National products.....	29	635	591	471
Imported products.....	16	602	453	308
FOODSTUFFS				
Average.....	20	584	526	463
Vegetal products.....	8	568	466	475
Animal products.....	8	599	599	448
Sugar, coffee, cacao.....	4	585	503	456
INDUSTRIAL MATERIALS				
Average.....	25	668	538	370
Minerals and metals.....	7	620	524	367
Textiles.....	6	689	473	264
Miscellaneous.....	12	662	630	436

On a gold basis (100 in 1913) the unweighted general index of wholesale prices was 84 at the end of December, compared with 102 in November, 1930, and monthly averages of 126 in 1929 and 110 in 1930.

WEIGHTED GENERAL INDEX OF WHOLESALE PRICES

The weighted general index of wholesale prices also declined proportionately from May to December, 1931. That index stood at 541 in January, at 540 in April, at 520 in May, at 500 in July, at 480 in August, at 473 in September, at 457 in October, at 447 in November, and at 442 in December, 1931, as compared to 541 in December, 1930, and monthly averages of 627 in 1929 and 334 in 1930. The weighted general index covers 126 articles and is based on 100 in 1913. The following tabulation gives the details of the weighted wholesale price indexes for October, November, and December, 1931, together with the monthly averages for 1929 and 1930.

WEIGHTED WHOLESALE PRICE INDEXES IN FRANCE

[Based on 100 in 1913]

Item	Number of articles	Monthly averages		December, 1931
		1929	1930	
General index.....	126	627	554	442
Agricultural and food products, total.....	39	579	523	491
Products of vegetable origin.....	24	547	473	474
Products of animal origin.....	15	632	614	518
Industrial products, total.....	67	669	579	400
Minerals and metals.....	17	560	538	423
Textiles.....	19	755	570	363
Hides and skins.....	14	471	422	260
Chemical products.....	35	596	579	458
Rubber.....	2	123	71	34
Paper.....	2	678	658	548
Lumber.....	2	963	968	622
Cement, brick, and glass.....	6	618	716	657

DOMESTIC AND INTERNATIONAL IRON AND STEEL AGREEMENTS

The continuance of the depression in the European steel industry during the whole of 1930 and 1931 and its accentuation through January of 1932 aggravated the critical position in which the Continental Steel Entente has found itself during the past year. As the members of the entente control only about 30 per cent of the world's steel production, the attempted control of the industry was never realized and its influence was greatly weakened in the past three years by dissident producers (chiefly Belgian) who insisted on having a free hand. With falling prices and competition of the keenest, those outsiders in themselves were sufficient to disrupt the smooth working of the entente, which has been holding together mainly on nothing more substantial than "gentlemen's agreements."

The Continental Steel Entente was formed at a time when the interests of the various member countries were practically identical. As long as there was community of interests, the entente accomplished its purposes. However, the current (early 1932) economic situation in the large European iron and steel producing nations varies widely from most nearly normal in France to a low degree of depression elsewhere, where both production and profits have fallen to an alarming degree. The former balance in production, consumption, and capital yield no longer exists, and in 1931 fears were freely expressed that the entente would cease to exist. (This, in fact, occurred as of March 31, 1932, upon the failure of the entente to take formal action for its promulgation.) Those producing countries, other than France, where the iron and steel situation is very bad are now making an effort, through the entente organization, to equalize and regulate production and prices in a manner other than that attempted without success in the immediate past. Even a movement to bring back a strict application of production quotas with fines for overproduction and bonuses for underproduction, with no attempts to fix prices, was started. As long ago as October, 1929, such a policy was admittedly not applicable, and the desire of some interests to go back indicates the desperate state in which the entente membership found itself because of the seemingly insoluble problems opposing any attempt to reconcile the interests of all of its members.

A common interest, such as existed during the generally favorable economic period in the greater part of 1929, no longer exists; in fact, there is now a great diversity of interests. The reasons for this are not obscure: Up to June, 1930, France alone of all the cartel members enjoyed nearly normal business conditions, its mills were operating at near capacity, there was little or no unemployment, and wages were being maintained at their relatively high level. (In the Longwy region real wages at that time were approximately 80 per cent higher than before the war.) In the other producing countries there were varying degrees of business depression, unemployment was growing rapidly, production dropped to less than 40 and in some instances 30 per cent of capacity, and wages had already been reduced to a certain extent thereby tending to further decrease the capacity for consumption. (Further general wage reductions of 10 per cent were made in Germany on January 1, 1932.)

Aside from the imponderable economic factors which are affecting the European iron and steel producers, what seems to be the main contributing factor in the comparatively strong position of the French industry and the weakness of the other large continental producers is the ability of the French plants to maintain their financial integrity while maintaining a comparatively high rate of production at the unremunerative prices ruling at present. The reason is that since the war the French have followed a very conservative financial policy. There has been little borrowing, and balance sheets show that earnings have been diverted to reserves. Following the war only those plants which were destroyed by the Germans have been rebuilt along modern high-production lines. Even in spite of the acute labor shortage in 1929 and early in 1930 small-capacity blast furnaces and antiquated rolling-mill equipment were kept in constant repair rather than install, at the expense of large capital outlay, modern labor-saving equipment. Germany, and to a lesser degree Belgium, followed a different postwar policy. In the former, the scrapping of the old plants and the extensive building of new plants to replace those lost to the French through the cession of Alsace-Lorraine was general. Belgium followed a somewhat similar policy in the remodeling of its blast furnaces and steel plant equipment, which was in a sad state of repair after its war operation by the Germans. Both countries devoted the larger part of their profits and even resorted to large-scale borrowing to carry out their modernization programs and now are in serious financial difficulties as a result of the prolonged depression.

In France the situation is totally different, as is shown by recent published balance sheets in which amortization charges and interest burdens are very low indeed. Dividend rates were generally maintained until early in 1931, although earnings had fallen off. There can be no doubt but that French iron and steel producers, as a whole, are in an excellent strategical position with respect to their Continental competitors and that they should easily weather the storm. It was only in December, 1931, that French exports experienced a serious decrease, although domestic sales had been gradually decreasing throughout the year. That the French will relinquish any of the advantages they now hold for the sake of preserving the Continental Steel Entente is extremely doubtful. On the other hand, they may be expected to realize the most out of the situation, particularly because of the recent evolution of the entente toward export sales comptoirs (begun August 1, 1930, with the comptoirs for semifinished products and beams). That the French are able to take advantage of the present peculiar situation is clearly shown by the maintenance of the volume of their exports, while the production of pig iron and steel declined in 1931 as shown below.

It may clearly be seen that, in fact, the only marked decline in exports was in December, 1931, and that was due almost solely to the depreciation of the English pound sterling.

TREND IN FRENCH PRODUCTION AND EXPORTS IN 1931, BY MONTHS

[In metric tons]

Month	Pig iron	Steel (ingots and castings)	Exports (all iron and steel products)	Month	Pig iron	Steel (ingots and castings)	Exports (all iron and steel products)
January.....	801,000	746,000	263,553	July.....	679,000	651,000	281,543
February.....	728,000	693,000	309,179	August.....	680,000	644,000	303,709
March.....	775,000	722,000	250,501	September.....	655,000	655,000	298,289
April.....	739,000	675,000	263,115	October.....	637,000	626,000	299,662
May.....	724,000	674,000	247,665	November.....	567,000	538,000	301,882
June.....	691,000	650,000	291,304	December.....	543,000	536,000	225,527

POSITION OF INTERNATIONAL CARTELS

Returning to the situation of the Continental Steel Entente—meeting in January, 1932, the various European iron and steel producers decided to prolong the International Steel Cartel until March 31, 1932. Countries participating were: France and the Saar, Germany, Luxemburg, Belgium, Hungary, Austria, and Czechoslovakia. Pourparlers took place in Paris in January, 1932, with a view to re-constituting the entente on an entirely new basis after March, 1932. The re-creation of international sales comptoirs to control the production of semifinished products is contemplated, and it is hoped that through it the production and sale of semifinished products will be more effectively controlled than was possible under the former system of controlling the production of raw steels only.

The first comptoirs to begin functioning will be those to govern semifinished products and beams. If these comptoirs are found to work satisfactorily, additional ones will be created for other products. The quota system will be applied to the export markets for the various countries adhering to the entente, the comptoir having the power to divert all foreign orders to those countries which have not exhausted their quotas. In the same manner, the local comptoir will apportion orders to the various domestic mills participating. The comptoirs (both local and international) will, of course, control prices. Naturally, the French are and will be at liberty to organize their own domestic market in the manner they desire. With this in view, the French steel mills signed an agreement on December 30, 1931, at Paris to remain in effect until the end of 1934. (The details of this agreement are given below in the section on French comptoirs.)

The Comptoir Belge, with headquarters at Brussels, was created to control the sale of foundry pig iron on the Belgian market. France, Belgium, and Luxemburg are members.

The International Rail-makers Association (l'Irma) includes Canada, the United Kingdom, France, Germany, Belgium, Luxemburg, the Central European group (Austria, Hungary, and Czechoslovakia), and the United States in its membership. The object of this cartel is to apportion rail orders among the several participants according to fixed quotas, and for this purpose headquarters are maintained in London. l'Irma was recently renewed until 1935.

The Wire Rod Cartel was recently renewed for five years commencing January 1, 1932. Headquarters are in Brussels. France,

Germany, Luxemburg, Belgium, Austria, Hungary, and Czechoslovakia are members. At the time of its renewal (November 30, 1931) a total quota of 360,000 metric tons was set for the first three months of 1932, but no information on individual quotas was disclosed, as this was considered confidential. The object of the cartel is to control prices.

The Tube Cartel, with headquarters in Duesseldorf, was also recently renewed, until 1935. Participating are the tube industries of France, Germany, Belgium, Luxemburg, Austria, Hungary, Czechoslovakia, United Kingdom, Canada, and the United States—the last three being at liberty to withdraw on March 31, 1932, or thereafter.

NOTE.—Subsequent to the transmission of the manuscript of this bulletin, Assistant Commercial Attaché William L. Finger (Paris) advised the Bureau of Foreign and Domestic Commerce that according to the Comité des Forges the French and Belgian metallurgical interests have reached a verbal agreement for the limitation of exports of all heavy metallurgical products between the two countries. Details of the arrangement have not yet been made public, but its general nature is understood to be that the French will agree to limit their exports to Belgium of steel merchant products, semifinished products, beams, and other heavy items to a fixed percentage of the Belgian domestic production; and that the Belgians in turn will make a similar agreement regarding their exports of these materials to France. Since the French domestic consumption is proportionately much higher than that of the Belgians, the percentage of the total Belgian consumption granted to the French will be higher than the percentage of the total French consumption granted to the Belgians. On March 29, the date of the report, no accord had been signed, although this step was anticipated for the near future.

FRENCH DOMESTIC COMPTOIRS

An agreement to control production among all the principal French steel manufacturers was signed on December 30, 1931, at Paris, to remain in effect until the end of 1934. Despite the fact that the French industry has held membership in the Continental Steel Entente since its inception in 1926, this action marks the first time that French producers have agreed among themselves to regulate the output of individual plants. The quotas apportioning the total production among the various French mills will be based on the average production of 1929 and 1930 and will be fixed by three experts whose decision will be final. However, these experts are authorized to modify the quotas in order to adapt them to present consumption.

The other important features of this agreement were as follows: Steps were to be taken before April 1, 1932, to renew the French existing comptoirs for a period of three years; new comptoirs for strips, thin sheets, and slabs are to be created before December 31, 1932, and members agree not to undertake the manufacture of new products, now regulated to other comptoirs, if they were not manufacturing such products before December 30, 1931.

The Semifinished Products Comptoir expired on February 18, 1932. However, according to the agreement referred to above, this comptoir was to have been renewed. It controls sales and prices.

The Rail Comptoir's life has been extended to 1935. It represents French interests in the International Rail Cartel and controls domestic production and prices. The various French railroad systems pass their orders through this comptoir.

The Beam Comptoir officially expired on February 18, 1932, but was to be renewed. It controls French production and prices.

The Wire Rod Comptoir has been extended until 1936. It represents the French wire rod interests in the International Wire Rod Cartel and controls domestic sales and prices.

The Sheet Comptoir has been extended until March 31, 1932. It controls only sheets over 2.75 mm thick (toles fortes). It represents the French sheet interests in the International Sheet Cartel. It controls domestic sales and prices.

NOTE.—Since this manuscript was written the Sheet Cartel has been reorganized into a 3-part organization—the first subdivision to direct the sale of sheet billets, the second of thick and medium weight sheets, and the third thin sheets.

The Merchant Shapes Comptoir has been extended until January 1, 1932. It represents the French merchant shapes interests in the International Merchant Shapes Cartel and Controls domestic sales and prices.

The Pipe Comptoir has been extended until 1935. Like most of the above it represents the French pipe interests in the International Pipe Cartel and controls domestic sales and prices.

Another recent development in this field includes an agreement reported reached in principle by French producers of hematite pig iron to establish a comptoir to have exclusive control of the domestic sale of this product.

GENERAL TRADE ORGANIZATIONS

The most important of the general organizations in the French iron and steel industry is the Comité des Forges, which acts for the industry as a whole in all important domestic and foreign matters of general interest. The Comptoir Siderurgique surveys the operation of the domestic comptoirs and their obligations vis-a-vis their international connections. Important regional organizations are the Association des Maîtres de Forges de Lorraine and the Association Minière d'Alsace et de Lorraine, which represent the large Lorraine steel and ore interests, respectively.

OUTSTANDING COMPANIES IN THE INDUSTRY

SOCIÉTÉ DES HAUTS FOURNEAUX ET FONDERIES DE PONT-À-MOUSSE

This company, which has specialized in the manufacture of cast-iron pipe since its founding, has a world-wide reputation through its exports of its specialty, which normally reach nearly 50 per cent of the annual production.

Historical.—The plant of Pont-à-Mousson was founded in 1856 by the Société Mansuy et Compagnie and consisted at the beginning of operations of two blast furnaces, in which charcoal was used as fuel, and one small foundry. From the start an arrangement was made (with the Société de Marbache) to obtain a regular supply of iron ore, and a very few years later the Marbache concession was acquired by Pont-à-Mousson together with five other iron-mining concessions in the Nancy region. In 1884 Pont-à-Mousson acquired two concessions in the Briey district, at Auboué and Mairy, and in 1905 the Moinville concession was obtained and linked up with that of Auboué. In the latter year blast furnaces were erected at Auboué-Moineville and a second-melting (remelting) plant was constructed at Foug, near Toul.

The company developed rapidly from 1905 to 1914, but its development was seriously checked from 1914 to 1918, owing to the fact that the plant at Pont-à-Mousson—by far the most important one—was situated within the war zone and was almost entirely destroyed. The Auboue mine was also occupied during the whole of the war and its yield to-day is only half that of 1914. In 1916 another second-melting plant was set up near Rouen and in 1917 and 1918 machinery plants were erected at Sens and at Toulouse.

The reconstruction of the plants located in the devastated regions was under way soon after the armistice, and by 1925 the company's pre-war production level was once more reached (except in the Auboue mine). Since 1925 the Société de Pont-à-Mousson has increased its production every year and at the present time employs nearly 8,000 workmen.

Through participation in various companies, Pont-à-Mousson has also become entirely independent as regards its supply of coal and coke. In 1905, following investigations undertaken by the company, a coal bed was discovered in Pont-à-Mousson itself and this is now being exploited.

Present situation.—The Société des Houts Fourneaux et Fonderies de Pont-à-Mousson at present exploits eight iron-mining concessions, from which in 1929, 1,454,700 metric tons of iron ore were taken as compared with 1,427,600 tons in 1928. The company has holdings in several Belgian and French coal-mining companies and is also interested in the company which has undertaken to investigate the extension of the Saarbruek coal beds in the direction of Pont-à-Mousson.

The plant at Pont-à-Mousson now consists of 5 blast furnaces, 12 cupolas, and 3 large pipe foundries. The plant at Auboue comprises three large blast furnaces for the smelting of raw pig iron. At Foug is located a second-melting foundry with 27 cupolas, and cast-iron pipe and other castings are manufactured there, notably segments for lining shafts and tunnels. The plant near Rouen is also a second-melting foundry and has 17 cupolas. The production consists chiefly of drain and irrigation pipes and economizers for steam boilers. At Sens, Pont-à-Mousson manufactures taps and water cocks, bronze castings, pumps, and rotatory compressors, while at Belleville all kinds of forgings are produced; mine cars, etc. There are also 3 plants at Pont-à-Mousson and at Auboue for the manufacture of white slag bricks, while the equipment at Pont-à-Mousson also includes 2 lime kilns, 2 coke ovens, and a plant for the capture of by-products.

The company's production of coke in 1929 was 257,800 metric tons, as against 222,700 tons in 1928; the production of raw pig amounted to 360,000 metric tons as compared with 341,200 in 1928; while the production of cast-iron products was 273,900 metric tons as against 270,400 metric tons in the previous year. Of the entire production of the company's foundries in 1929, 42 per cent was exported, and according to the annual report of the company, the 1929 actual production represented only two-thirds of the production capacity of the various cast-iron products. Total net sales in 1929 amounted to 338,161,000 francs, or 67,598,000 gold francs (compared with 57,967,000 gold francs in 1928), leaving a stock of cast-iron products of approximately 100,000 metric tons, which has remained stationary at that figure for some time.

Works completed and undertaken.—Various patents and licenses have recently been acquired by the Société de Pont-à-Mousson pertaining to the manufacture of pipe by the centrifugal process. Many tests have been carried out, but up to the present the company's engineers are not convinced that these methods would prove more satisfactory than those at present employed. In all, the total expenditure in 1929 for new construction and improvements was 15,400,000 francs; in 1930, 14,300,000 francs. More recently added equipment includes a turbine of 3,800 to 5,000 kilowatts installed at Pont-à-Mousson; a gasometer of 20,000 cubic meters has been constructed and conduits laid from Pont-à-Mousson to Dieulouard to allow the sale of the excess coke-oven gas; while new decantation basins and a dephenolization plant have been installed at Pont-à-Mousson for the refining of residuary water from the coke plant.

Holdings, issues.—The companies in which the Société de Pont-à-Mousson holds interests are all doing well. In the course of last year an American company was founded. The total net profits of the company in 1929 amounted to 11,723,097 francs; in 1930 to 11,342,000 francs.

LES PETITS-FILS DE FRANCOIS DE WENDEL ET CIE.

This company is the largest producer of pig iron and steel in France. In 1930 the various plants of the company, located in Lorraine, produced about 17 per cent of the total French pig production and about 23 per cent of the total French steel production. Founded in 1805 by Francois de Wendel, the company has since that time been owned exclusively by his direct male heirs, and during the German occupation (1870-1918) the de Wendels were the main pillar of the French tradition in Lorraine. The company, organized under French law as a partnership, owes its present degree of development to the foresight of the de Wendel who, in 1881 built the first battery of basic converters to be constructed in Europe. The Thomas process of steel making was the first to permit the cheap reduction of the high-phosphorus-content Lorraine ores. The activities of the company are centered at Hayange in Lorraine, where in 1845 only about 20,000 tons of ore were extracted annually. The impetus given to the industry by the de Wendels was such that they alone extracted 5,143,000 tons of ore in 1929, all of which were reduced in their own furnaces.

The 26 blast furnaces operated by the de Wendels are supplied with ore from various mining concessions, having a total area of 7,440 hectares (1 hectare equals 2.47 acres). The extraction is at the rate of 16,000 tons per day. The mineral is mined exclusively by the use of the liquid-air explosive developed by the company and is transported from the mines to the blast furnaces by an aerial cableway nearly 5 kilometers (2.7 miles) long.

It has been the consistent de Wendel policy not to make large investments in replacing obsolete plant by modern high-production equipment. Old blast furnace, converter, and rolling-mill units have been kept in repair in nearly all instances. The sole exceptions which can be cited are the three blast furnaces at Hayange, which had their antique chargers replaced by up-to-date American equipment. The mill at Joeuf is the only modern unit in the entire organization. As

it was always in France—just across the Lorraine border—it was completely destroyed by the Germans after their retreat from occupied territory. The mills at Hayange and Moyeuvre were intact after the armistice, but in a very bad state of repair. The main plant at Hayange has 10 blast furnaces of about 200 tons daily capacity, one battery of five 60-ton open-hearth furnaces, and a battery of basic Bessemer converters having a capacity of about 2,000 tons of steel per day. In addition, two other near-by plants of the company, one at Joeuf, the other at Moyeuvre, have batteries of Thomas converters. The plants at Hayange and Moyeuvre are in no sense modern. The blast furnaces are individually of small capacity, and though from a furnace standpoint this capacity could be increased to some extent it is stated that the existing blowing engines could not supply the additional air which would be required. The rolling mills are all steam driven and are slow in operation, and several cooling beds are manually operated.

Following are the principal characteristics of the various de Wendel mills.

Plant at Hayange.—Ten blast furnaces, battery of 6 basic converters (capacity 2,000 tons per day), battery of 10 open-hearth furnaces (capacity 65 tons), one 1,100-millimeter blooming mill, one 950-millimeter blooming mill, one 880-millimeter mill, three 770-millimeter mills, two 650-millimeter mills, one slab mill, four plate mills (including one for tin plate having a capacity of 1,550 tons per month.) All of these units are considered obsolete in the light of modern practice with the exception of the three partially modernized blast furnaces already referred to. In addition, the de Wendel interests operate a brick plant at Hayange, where all the refractory bricks required in their various plants are made. The same plant makes building bricks as well, using blast furnace slag as the principal ingredient.

Moyeuvre plant.—Historical records show that iron has been melted on the present site of the Moyeuvre plant continuously since the year 1871. At present 8 blast furnaces are in operation together with 3 batteries of coke ovens (165 ovens in all), a battery of 7 Thomas converters, and a blooming mill. Billets are sent to the Jamailles mill, at a distance of 3 kilometers, for rolling into merchant shapes. The excess coke-oven gas is sold to the neighboring towns of Moyeuvre, Metz, Hagondange, Thionville, and Hayange for domestic and municipal use. A plant for the recovery of tar, sulphate of ammonia, etc., is also attached to the coke-oven plant. The blast furnaces, with a combined capacity of 1,300 tons each 24 hours, produce high-quality foundry pig and spiegeleisen. The secondary plant at Jamailles has in operation three rolling mills of from 365 to 600 millimeters and seven smaller mills ranging in size from 250 to 300 millimeters.

Joeuf plant.—The Joeuf plant has 8 blast furnaces in operation—4 of 150 tons capacity, and 4 of 220 tons capacity, a battery of Thomas converters of 14 tons capacity, a 1,800-millimeter blooming mill, a rail mill, 2 smaller mills, and a wire mill. All rolling mills at this plant are electrically driven. The blast-furnace gas not consumed in the heaters is converted into power through a modern steam turbine plant. Blowing engines and accessory equipment are

all electrically driven. The power produced in excess of plant requirements is sold to neighbouring public-utility companies.

The combined production of all the de Wendel properties in 1930 is recorded below. The 1931 production—if the rate of output of the first eight months was continued to the end of the year—should not have varied from the 1929 figures by more than 10 per cent.

	Metric tons		Metric tons
Iron ore.....	4, 495, 000	Merchant shapes.....	311, 500
Coke.....	325, 000	Wire rods.....	104, 000
Pig iron.....	1, 660, 000	Plates and slats.....	139, 000
Steel.....	1, 582, 000	Tin plate.....	21, 000
Right-of-way material.....	243, 000	Slag fertilizer.....	262, 000
Beams.....	249, 000		

In the same period the de Wendel mills consume:

	Metric tons		Metric tons
Coal.....	280, 000	Iron ore.....	4, 675, 000
Coke.....	1, 996, 000	Manganese ore.....	97, 000

In the face of the world depression in the steel trade (France has been much less affected than all other producing countries), the de Wendels are reaping the fruits of their conservative financial policy. De Wendel investments in plant have been written off long ago, and they have, as a result, no large amortization charges to burden them during a period when prices are very low and when the immediate steel future is uncertain at best. The French trade press is continually referring to selling prices in Germany and Belgium as being dangerously near the cost of production, and even the banks interested in the steel industries in those countries where enormous sums were spent in new plant equipment are becoming decidedly nervous. But French producers, and notably de Wendel, have nothing to fear in that respect. Their reserves are intact, and, what is more, dividends are being maintained to a surprising degree by many companies.

In June, 1930, the company had 22,450 employees on its pay roll.

The open-hearth steel produced by this company is rolled exclusively into plates by its own mills. The other rolling-mill products manufactured by the company are rolled only from the Thomas steel which the company produces.

ACIÉRIES DE LONGWY

The most important mill at Longwy is the Société Anonyme des Acières de Longwy, capitalized at 157,500,000 francs, and having its principal plants at Mont St. Martin and at Sedan. Equipment at these two principal plants is as follows:

The Mont St. Martin plant.—This plant includes 7 blast furnaces (2 new blast furnaces at present being constructed), 12 gas-blowing engines, 12 electric-generating units (total of 54,000 horsepower); a basic steel plant of 5 converters (capacity 24 tons) and 2 mixers; an open-hearth plant of 5 furnaces (2 of 25 tons, 3 of 60 tons) and 1 mixer (capacity 350 tons); 10 rolling mills; pig, steel, and brass foundries; and a briquetting plant.

Production at this Mont St. Martin plant includes ores, chalky from Briey Basin and silicious from Longwy district; pig iron, both foundry and basic; raw steel (basic and open-hearth steel of all degrees of hardness, delivered in ingots, billets, blooms, slabs, etc.); structural shapes of all sizes and profiles; railway material, including rails, frogs, switches, etc., for tracks of all dimensions; heavy sheets, 10 to 40 millimeters thick and up to 3,800 in width as well as sheeting for boilers, naval construction, etc.; sheets (plates), 8 to 10 millimeters thick, for such metallic construction as reservoirs, gasometers, etc., and flat, square, and round bars, rounds for pipe, angles, T irons, reinforcing rounds, etc.; machine steel, iron and steel castings, iron and steel rollers for rolling mills, second smelting vats, etc., are also made here, together with such by-products as phosphorus slag for fertilizers, slag brick, building blocks, and broken and sifted ballast. The Mont St. Martin plant employed 6,744 workmen in 1913 and had 5,357 on its rolls at the beginning of 1931.

The plant at Sedan.—This plant consists of 1 rolling mill for medium-weight sheets, 6 rolling mills for light sheets, and 1 galvanizing shop. Its products include medium sheets of 2 to 8 millimeters in thickness, light sheets of 0.4 to 2 millimeters, foundry pig iron, and rolling-mill cylinders. Workmen to the number of 963 find employment here.

The two plants of this company produced the following: Pig iron, 364,680 tons in 1913, 476,700 tons in 1929, and 369,500 tons in 1930; steel, 314,234 tons in 1913, 537,918 tons in 1929, and 529,000 tons in 1930.

Other units in the Aciéries de Longwy include plants at Venisieux (Rhône) for the repair and rebuilding of railroad passenger and freight cars, and one at Beillemont, near Verdun, for quarrying. The company exploits 8 iron mines, of which 6 are located in the Longwy Basin and the remaining 2 in the Briey Basin. Shaft mining is practiced in the latter two mines, while the gallery method is employed in those located in the Longwy Basin. The total annual production of these six mines is about 1,500,000 tons of ore, of which some 1,200,000 tons are consumed in the plants of the company and the remainder sold.

In 1930 all the blast furnaces of the Aciéries de Longwy were kept in constant operation, with the exception of two which are being rebuilt. The only handicap they experienced during the year 1929-30 was the shortage of labor. The net profits realized by this company in the year 1929-30 amounted to 52,000,000 francs. Salaries and indemnities to workers for accidents, bonuses, etc., paid out in the last financial year amounted to 125,404,030 francs; a sum of 25,000,000 francs was paid in taxes, and a 16 per cent dividend amounted to 16,500,000 francs.

Various construction projects are being carried out at the present time. The company is extending its coking plant, in which all by-products will be recovered, thus decreasing manufacturing costs generally. New rolling mills are being constructed at Sedan and will shortly be put in operation for the production of specialties. A number of new workmen's dwellings have been constructed in proximity to all the mills and mines, and it is hoped that the more

plentiful and comfortable lodgings now available will do something to improve the labor shortage which seriously hampered production in 1929-30.

SOCIÉTÉ LORRAINE DES ACIÉRIES DE ROMBAS

This company, capitalized at 150,000,000 francs, produced 698,000 tons of pig iron in 1928 and employed a force of 7,000 workmen in that year. The production equipment in its two plants (at Rombas and at Maizieres) includes 8 blast furnaces, 6 basic converters, 4 open-hearth furnaces, 11 trains of rolls, and 3 brick-making plants. The principal items which it offers for sale are: Iron ore, Thomas pig iron, foundry pig iron, semifinished products (ingots, blooms, billets, slabs), Bessemer and open-hearth merchant shapes, rails, frogs, switches, fishplates, slag bricks, and fertilizer.

SOCIÉTÉ MÉTALLURGIQUE DE KNUTANGE

This company, expropriated from the Germans in 1919, is now controlled by the Schneider-de Wendel interests. Its capital is 75,000,000 francs. Production equipment includes 10 blast furnaces of from 200 to 250 tons capacity, six 30-ton basic converters, 10 trains of rolls, a cast-iron foundry, a brick plant, and a cement plant. In 1930 this company produced 659,000 tons of pig iron and 579,800 tons of steel and on December 31 of that year employed 4,890 workmen.

COMPAGNIE DES FORGES DE CHÂTILLON, COMMENTRY ET NEUVES-MAISONS

This is a limited-liability company, capitalized at 45,000,000 francs, with equipment of 11 blast furnaces of from 120 to 250 tons capacity, 8 basic converters varying in capacity from 10 to 20 tons, 13 open-hearth furnaces, 2 electric furnaces, 1 crucible furnace, 38 trains of rolls, and 14 shops for boiler making, forging, wire drawing, etc. The company specialized in railway (permanent way) material, merchant shapes, special steels, and hot-rolled, full-finished automobile sheets made under American license. Its 1930 pig-iron production amounted to 424,100 tons and its steel production to 468,600 tons.

COMPAGNIE DES FORGES ET ACIÉRIES DE LA MARINE ET D'HOMÉCOURT

This company, capitalized at 180,000,000 francs, owns plants both in the center and in the east, the principal one being at Homécourt. Combined equipment comprises 11 blast furnaces, 11 open-hearth furnaces, 7 converters, 8 electric furnaces, and 21 trains of rolls. The company builds locomotives and heavy machinery at Saint-Chamond in the center and produces special steels at its Lorette plant, which is also in the center. The combined production in 1930 was 436,500 tons of pig iron and 436,400 tons of steel. The former Rombacher Huettenwerke and the blast furnaces at Redange (Lorraine) were acquired from their former German owners in 1919 through expropriation.

SOCIÉTÉ MÉTALLURGIQUE DE SENELLE-MAUBEUGE (AT LONGWY)

This company is of less importance than the Aciéries de Longwy, but its plant is striking because of its up-to-date and well-planned equipment. The Société Métallurgique has four blast furnaces in operation (two modern 800-ton blast furnaces are in construction), a basic converter steel plant, an open-hearth plant, rolling mills, and construction shops at Senelle, where pig iron, basic Bessemer, and open-hearth steel in ingots, billets, blooms, and slabs, structural shapes, and railway material are produced. Slag is granulated for cement and ballast, and all by-products are collected and utilized.

The company has a coal concession in the Nord Department and operates a coking plant adjacent to this mine as well as another at Senelle. It owns two iron-mine concessions and participation in four or five others. This company has specialized in equipment for mines and metallurgical plants and appears to be developing rapidly in several directions. Unlike the Aciéries de Longwy, it has as yet no direct sales organizations.

SOCIÉTÉ DES FORGES ET ACIÉRIES DE NORD ET LORRAINE

This company, capitalized at 80,000,000 francs, has its plants at Uckange (Moselle). Equipment includes six blast furnaces, which formerly were owned by the Stumm (German) interests, and production includes ferro-alloys, calcium carbide, cyanamide, liquid oxygen, slag bricks, fertilizer, and pig iron. In 1930 production amounted to 400,000 tons of pig iron and 2,500,000 tons of iron ore; 2,300 workmen were employed in December of that year. The company has 6 mining concessions totaling 2,315 hectares.

UNION DES CONSOMMATEURS DE PRODUCTS MÉTALLURGIQUE ET INDUSTRIELS

This company, capitalized at 105,000,000 francs, assumed control of the former Thyssen (German) plant at Hagandange in 1919. As the name implies, the principal interests in the company are large consumers of iron and steel products. Among them are the Peugeot Automobile Co., the Compagnie Fives, Lilles (large machinery manufacturers), the Société Alsacienne de Constructions Mécanique (heavy, electrical equipment and machinery manufacturers) Louvroie Recquignies (pipe manufacturers).

Present equipment consists of a coke-oven battery of 66 ovens, nine 350-ton blast furnaces, five 30-ton Thomas converters, one 70-ton and one 80-ton open-hearth furnace, rolling mills of 925, 850, 525, 400, and 300 millimeter capacities, a continuous plate mill, a cement plant having an annual capacity of 300,000 tons, mines, etc. The various properties of the company are served by 120 kilometers of privately owned standard-gage railway tracks.

Twelve mining concessions covering 7,150 hectares are owned by the company whose 1919 production was 575,300 tons of pig iron, 591,900 tons of steel, and 174,200 tons of cement. On January 1, 1930, 6,985 workmen were on the pay roll.

DISPOSAL OF FORMER GERMAN PLANTS IN LORRAINE

The methods by which five French groups have acquired control over the properties in former German Lorraine were not uniform, but they have many of the characteristics of what is commonly known in the United States as a holding trust. The French firms associated themselves to acquire the majority of the capital stock of the Lorraine property taken over. The Lorraine establishments thus become controlled by a group of similar enterprises, which hold their capital and which are bound together by a community of interests.

The names of the five groups which have taken over the German properties, the companies interested in each, and the properties acquired are given below. The first two groups are much the most important, since they include the leading metallurgical interest of France—de Wendel and Marine-Homecourt.

SCHNEIDER AND DE WENDEL

Interests included.—Schneider et Cie; Les Etablissement de Wendel; Les Forges de Chatillon-Commentry; Les Aciéries de Saint-Etienne; Denain-Anzin; and Senelle-Maubeuge.

Properties acquired.—Aumetz-la-Paix, now known as the Société Métallurgique de Knutange; Terres-Rouges (Gelsenkirchen), known as Société Minière des Terres-Rouges; and Société Métallurgique des Terres Rouges.

THE CONSORTIUM HEADED BY THE SOCIÉTÉ DE LA MARINE-HOMECOURT

Principal interests.—La Société de la Marine-Homecourt; Aciéries de Michéville; Aciéries de France, Les Forges de Pont-à-Mousson; Les Mines et Forges d'Alais, Les Fonderies de Bayard à Saint-Dizier; L'Etablissement Capitain-Génie; La Société des Ateliers et Chantiers de France; and Les Etablissements Dellatre et Frouard Réunis.

Properties acquired.—The property of the Rombachen Huttenwerke; certain French interests in the Saar; the blast furnaces of Redange; and the mines and factories of Ottange.

SOCIÉTÉ LORRAINE MINIÈRE ET MÉTALLURGIQUE

Interests included.—Aciéries de Longwy; Hauts-Fourneaux de Saulnes; Saintignon et Cie.; Société Métallurgique de Gorcy; Tréfileries du Havre; Les Etablissement Hotchkiss et Decauville; and Les Forges de la Chiers (Belgian).

Properties acquired.—The Roehling mining and metallurgical establishments at Thionville.

LA SOCIÉTÉ DES ACIÉRIES DU NORD ET DE LORRAINE

Interests embraced.—Les Aciéries du Nord et de L'Est; Les Forges de la Basse-Loire; Les Mines de Segré; Les Ateliers et Chantiers de Bretagne; and La Société Métallurgique de Pont-à-Vendin.

Properties acquired.—The Stumm mines and factories in the Uckange region.

SOCIÉTÉ COOPERATIVE DES CONSOMMATEURS

Interests numbered in this group.—L'Union des Consommateurs de Produits Métallurgiques, a group of transforming interests which has control of blast furnaces and steel mills.

Properties acquired.—The Thyssen works at Hagondange.

It was common comment, in the period following the war, that French industrial organization was not such as to justify that hope that France would be able to make the equipment she had acquired

from Germany yield as it had for its former owners. Events, even under the abnormal conditions of recent years, do not confirm such a belief. After all, the engineering experience and practice in the east and west part of the artificially divided Lorraine Basin did not show marked contrast before the war. In fact, one of the largest and best-managed companies (de Wendel) in Lorraine was already owned and largely managed by French interests.

FUTURE OF THE FRENCH IRON AND STEEL INDUSTRY

In view of the very unstable world conditions ruling at present and in the face of a growing depression in France itself, it would be most hazardous to prognosticate on the immediate future of the French iron and steel industry. At the time of this writing (February, 1932), production of both pig iron and steel is declining, as are prices of iron and steel products in both the domestic and export markets. It seems probable to many in the French industry that prices have reached the bottom or are near it, and even very likely that the deflationary process has gone too far. However, when stabilization will set in is impossible to foretell. In any case, it is felt here that a reduction of production costs must be brought about, and that mostly through a downward revision of the wage scale. Some wage reductions have been made, but it is thought they have been not large enough or sufficiently general (to judge from experience elsewhere, notably in Germany) to permit a return to normal conditions.

Although the French iron and steel industry is passing through a period which is becoming increasingly difficult, there seems no doubt but that it can weather the storm. The financial policy of most producers has been highly conservative—in keeping with a marked national trait. Reserves have been kept intact and in fact added to in many instances in the period up to the end of 1930, and no expensive general construction and modernization of equipment programs have been entered into.

There can be no question but that the French industry is established on what is essentially a sound basis and that it will be able to continue to hold the high position it has gained in the postwar period. The country is becoming increasingly industrialized, the consumption of steel per inhabitant is growing rapidly, and the large French colonial empire is already appearing as a major market which is closed to foreign competition to nearly the same degree as metropolitan France.

FOREIGN TRADE

FRENCH TARIFF POLICY

The French tariff policy is one of protection for domestic industries on the one hand and of reciprocity or "bargaining" for the benefit of export industries on the other. This is radically different from the tariff policy of the United States, which is based on the unconditional most-favored-nation clause without provision for reciprocal concessions in import duties (excepting, of course, our treaty of reciprocity with Cuba). It has not been found possible, as yet, to reconcile these differences sufficiently to permit the negotiation of a most-favored-nation treaty of commerce between the two countries. Consequently, the United States does not enjoy the lowest rates of French import duty on all of its products.

Several countries do receive uniformly the minimum schedule or lowest rate of the French tariff for their products; the most important among these are Sweden, Norway, Denmark, Great Britain, Germany, Netherlands, Switzerland, Hungary, and Czechoslovakia. Other countries have agreements with France providing for the minimum duties on certain products and intermediate or higher duties on others. This second group includes Canada, Spain, Finland, and Latvia.

POSITION OF AMERICAN EXPORTS

The treatment accorded products from the United States resembles that accorded the latter group; that is, American goods receive the minimum rates under certain tariff classifications, intermediate rates on others, and the maximum rates on still another group. The basis for this treatment is certain French legislation of 1910. In 1927 there occurred a general increase in French tariff rates, to meet monetary conditions resulting from the de facto stabilization of the franc and to readjust the tariff scale which in some cases had declined to a fraction of the pre-war height in relation to the value of the goods on account of the depreciation of the franc. Another purpose in raising the tariff barrier was to grant certain French industries additional protection against their German competitors, to whose products the minimum schedule of the tariff was accorded by the Franco-German commercial treaty of 1927.

Following this tariff readjustment and the conclusion of the Franco-German commercial treaty, the very high rates of the new French maximum tariff schedule were applied to a large number of American products previously enjoying the benefit of the intermediate rates. There followed negotiations between the United States and French Governments, resulting in an informal agreement under which, by the French decrees of November 15, 1927, March 15, May 12, and June 28, 1928, American products were reestablished in approximately the same relative position under the French customs tariff as before.

IMPORT QUOTA SYSTEM

During 1931 France began to establish, as temporary measures, import quota restrictions limiting the importation of certain specified products to fixed quantities for stated periods, usually of three months. Specific quotas are generally fixed for imports from the principal supplying countries. Early in 1932 import quotas were established on certain iron and steel products (mainly on certain types of sheets), and quotas on a number of additional products were under consideration. The quotas apply to imports into France and Algeria, but not to imports into French colonies and protectorates.

COLONIAL TARIFF POLICY

The customs régime applying to imports into the French colonies and protectorates is not uniform. From the point of view of the tariff régime, these regions of import are divided into two main groups, with an intermediary group, as given below.

FRENCH TERRITORIES UNDER SAME SCHEDULE AS FRANCE

This group, comprising Madagascar and dependencies (Diego Suarez, the Comoro Islands, and Nossi Be), Guadeloupe and dependencies, Martinique, French Guiana, and Reunion, is assimilated in the mother country, and the imports of foreign origin are subject to the same general intermediate or minimum tariff rates as would apply on similar importations into France or Algeria (Algeria being administratively an integral part of France).

THE INDO-CHINA SCHEDULE

French Indo-China (Cochin China, Cambodia, Annam, and Tonking) formerly belonged to the first group (above), but is now intermediate between the two tariff-schedule groups, as it has a separate tariff schedule, that, while closely resembling the French schedule, is nevertheless distinct from it. This is a two-column schedule with general and minimum rates, the former being four times the latter. This new tariff schedule became effective on July 24, 1929, before which time the French (national) tariff schedule applied in this colony with a few exceptions. Under recent customs rulings, merchandise imported into French Indo-China from the United States, with the exception of a limited number of articles, has been placed under the terms of the general tariff. French goods enter this colony duty free, and foreign goods that have been nationalized in France by the payment of duty also enter duty free, unless the rate applicable in French Indo-China is higher than the rate applicable in France, in which case the difference between the two rates is levied in Indo-China.

FRENCH TERRITORIES HAVING INDEPENDENT SCHEDULES

In this group, comprising the dependencies of Senegal, French Sudan, Upper Volta, French Guinea, Mauretania, Territory of Niger, St. Pierre and Miquelon, the Leeward Islands, French Oceania (Tahiti and dependencies, the Marquesas, Tuamotu, Gambier, Tubuai, and Rapa), imports originating in France or Algeria enter duty free, except where otherwise stipulated in commercial treaties.

Foreign products entering the territories that are members of this group are subject to special tariff rates entirely independent of the French customs tariff.

MEDITERRANEAN COLONIES AND PROTECTORATES

Algeria.—Products of French origin and foreign products nationalized in France by the payment of import duties have free entry into Algerian ports provided they are directly imported in French, Tunisian, or Moroccan bottoms.

Foreign merchandise reexported from France or transshipped in a French port are treated on arrival in Algeria as if they had come directly from the country of origin, paying the same rates as apply to imports into France.

Tunis.—Tunis has the status of a protectorate with a separate tariff schedule, but is it gradually being brought into closer customs relationship with France. An ever-increasing number of articles are being removed from the Tunisian tariff schedule and made dutiable under the French schedule, while provision is made at the same time to allow for the duty-free entry of these goods into Tunis when of French origin. Consequently, the majority of French products now enter Tunis free of duty, yet some are subject to a preferential rate, and a few others are subject to the same tariff treatment as apply to products of other countries, regardless of their origin.

Morocco.—French and foreign products are subject equally to the special Moroccan tariff regime.

NOTE.—Information as to the prevailing rate of import duty on specific articles to be exported to France or to any of the enumerated French colonies, possessions, or protectorates can be secured at any time upon making application for the same to the division of foreign tariffs, Bureau of Foreign and Domestic Commerce, at Washington.

EXPORTS

Not the least of the changes wrought in the French iron and steel industry by the World War was its elevation to a ranking position among steel-exporting countries from one of comparative insignificance in the pre-war year 1913. Productive equipment, increased by the addition of the former German plants in Lorraine and by the additions to French plants made during war years, had a capacity practically double that available in France at the outbreak of hostilities, but domestic consumption, although greater than in those earlier years, no longer was a mere 10 per cent smaller than production so that economical operation of plants and equipment dictated an active export policy. That this policy was carried out is indicated by the fact that in 1927 and 1928 France exported more iron and steel than any other country and that since those years she has been exceeded in this respect only by Germany—French exports in 1930 being six and one-half times as great as in 1913.

In contrasting 1930 with 1913 and considering only that production accomplished within the territory held by France in each of those years, we find the tonnage of iron ore mined to be greater by 121 per cent, the quantity of pig iron melted to be larger by 94 per cent, and the output of crude steel increased by 101 per cent. No exact figures on French domestic consumption are available, but it is of interest to note that exports in 1913 represented 13.4 per cent of

production, whereas in 1930 shipments to foreign countries made up 43.2 per cent of the local output, the volume of this trade having risen from 629,674 to 4,067,640 metric tons. Since in 1929 exports amounted to 44.2 per cent of production, it would appear that this proportion represents what is probably the approximate normal ratio obtaining between output and exports as distinguished from 1927, when 68.4 per cent of all the steel made moved in export trade.

Details of the export trade in several of the principal classes of products are given in the accompanying table (complete figures not being available). Inasmuch as shipments of the unnamed classes amounted, in all probability, to nearly three-quarters of a million tons in each year, no total figures are given for the indicated countries of destination. Products not reported in this table include structural materials, hoops and bands, railway track material (other than rails), axles, anchors, nails, and other miscellaneous iron and steel products.

EXPORTS OF IRON AND STEEL PRODUCTS FROM FRANCE,¹ 1930 AND 1931

[In metric tons]

Countries of destination	Pig iron		Ingots, blooms, billets, slabs		Ferro-alloys		Bars		Rails		Plates		Pipe	
	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931
Union of Socialist Soviet Republics				20	148	89	2,494	7,081	13	986	15	4,913	400	1,081
Sweden	5,459	4,198	40	2,201	22	1	24,898	36,052	429	237	1,527	2,082	259	99
Norway	87	411	3,927	1,181	4	22	17,365	19,094	1,106	336	1,764	1,181		9
Denmark	15	56	245	541		15	21,690	30,674	10,037	13,741	645	1,673	570	95
Great Britain	78,489	73,728	119,008	168,662	41	343	323,613	355,645	26,283	16,492	3,649	12,773	2,322	1,726
Poland	75	20	21	85		1,316	63	826	600	963	32	1,276	335	82
Germany	104,827	79,977	83,328	59,839	883	1,846	387,801	244,113	93,819	66,682	66,374	55,703	3,215	2,046
Netherlands	9,044	6,673	1,487	2,114	165	822	17,563	33,530	11,846	15,277	8,209	2,871	2,882	2,478
Belgium-Luxemburg	171,568	151,608	233,504	119,100	6,176	4,562	108,790	100,297	11,204	5,856	18,951	25,286	8,281	6,208
Switzerland	49,243	40,295	74,343	81,933	342	434	130,245	129,685	22,400	16,925	30,320	24,738	8,076	3,546
Czechoslovakia	561	217		96		74	144	145						27
Italy	80,072	49,334	127,677	79,249	446	773	28,924	27,830	14,246	14,814	6,945	1,692	79	89
Jugoslavia	632	144					296	82					7	15
Rumania	516	203					833	1,116	17,261	10			26	1,218
Greece	195	1,947	1,076	1,043			8,720	10,339	315	24	520	349	743	401
Turkey	66	270	67	119	1	1	2,093	2,996	15,358	11,888	187	26	1,470	537
Spain	4,517	1,007	107	303	1,524	507	4,269	5,622	11,882	8,602	448	627	744	391
Portugal	1,832	3,008	2	8	14	6	5,320	9,287	5,422	1,572	134	160	1,082	395
Egypt	279	313	442	138			16,346	19,805	7,886	6,244	410	1,332	583	1,156
Japan	73		2,320	529		14	12,987	2,877		61	1,952		3,336	929
United States	661	427	215	178	277	174	43,645	40,355	545	227	164	154	512	20
Brazil	203	10	115				2,285	951			48	94	457	246
Argentina	7,404	1,807	644	997			48,191	29,172	10,510	1,705	2,132	1,868	1,614	477
Canada				368	11	47	1,693	1,943			185			167
Algeria	2,271	1,973	144	859	8	14	74,692	105,701	26,900	40,497	6,877	8,810	5,575	5,457
Tunisia	151	155	57	24		2	22,632	28,158	1,075	4,130	8,812	2,821	2,108	1,573
Morocco	333	208	19	28			13,756	9,789	8,425	14,745			1,606	1,921
French West Africa	1,031	58	16		5		4,649	2,656	3,734	5,306	475	162	658	1,239
Madagascar	24	31					4,303	3,783	684	617	503	704	426	324
French Indo-China	1,842	861	176	29		2	30,054	11,881	2,025	6,891	4,309	1,769	916	975
Other French colonies	211	32	7	15	1		5,584	4,362	5,906	4,719	1,714	1,266	875	868
Other foreign countries	5,949	4,043	548	1,219	221	484	89,987	84,476	22,756	19,914	3,157	5,264	6,054	2,881
Total	527,065	423,062	649,531	520,288	9,837	11,148	1,428,692	1,355,328	330,326	279,474	159,443	160,142	57,682	38,169

¹ The French foreign-trade statistics, compiled by the semi-official comité des Forges, embrace the foreign trade of the Saar.

EXPORTS OF IRON AND STEEL PRODUCTS FROM FRANCE,¹ 1930 AND 1931—Continued

[In metric tons]

Countries of destination	Hot-rolled full-finished sheets		Tin plate		Hot and cold rolled strip		Wire rods		Wire		Tool steel, 1931 ²	Tires and hubs, 1931 ²	Cast-ings, 1931 ²	Special steels, 1931 ²	Recept-ents, 1931 ²
	1930	1931	1930	1931	1930	1931	1930	1931	1930	1931					
Union of Socialist Soviet Republics.....				105					65	10			2		
Sweden.....				2	388	1,554	5,477	6,310		358			6,798	2	
Norway.....	1			10	619	1,834	1,383	3	123	90			2,867		
Denmark.....				1	1,184	1,321	19,049	16,624	1	510			2,081	5	10
Great Britain.....	9	4	10	122	35,603	53,280	20,622	16,743	844	1,331	102	466	4,485	251	3
Poland.....		1					66	1	10	28		249	99		11
Germany.....	116	181	11,278	13,650	35,011	26,071	54,459	31,576	23,898	36,642	29	3	26,459	16	14
Netherlands.....	1	2	53	111	250	1,139	3,161	3,660	877	48	4	54	29,279		17
Belgium-Luxemburg.....	10	36	500	2,629	5,510	6,236	14,908	23,653	1,029	1,215	572	1,522	4,983	236	20
Switzerland.....	434	172	686	1,491	3,401	5,025	6,887	10,158	1,232	220	12	215	6,180	22	66
Czechoslovakia.....	1	2			2	4	81			1	2		2	36	
Italy.....	12	20	117	797	538	846	723	608	167	239	49	243	12,066	571	3
Jugoslavia.....	1				78	10					4	523	1		2
Rumania.....				8	63	3	494	295	44		1	30			2
Greece.....	45	10	36	134	17	3	1,469	3,141	78			15	2,983		1
Turkey.....	21			3	98	40		18	255	690	5	190	1,553		1
Spain.....	337	204	6	4,426	682	364		11	115	127	94	537	597	1	60
Portugal.....	2	1		326	494	528		33	56	36	51		1,226	64	6
Egypt.....	138	3	9	2	115			319	101	268	3	4	4,579	2	1
Japan.....		1	77	40	3,139	1,329	6,784	11,442	587	107					
United States.....				20	5,513	5,934	1,053	2,238		6	2		4,369		
Brazil.....	4	2	137	35	99	21			50	86	1	38			
Argentina.....		2	20	69	399	334	722	185	865	400	3	563	9,831		
Canada.....					133	126	2,858	2,786	2,064	1,118			1,064		4
Algeria.....	193	227	4,481	2,941	3,171	3,248	636	1,735	6,803	10,129	152	2,028	20,671	53	164
Tunisia.....	283	129	1,396	1,494	708		545	549	780	748	24	198	2,445		25
Morocco.....	135	93	351	776	49	61	1,082	927	595	64	45	253	8,981		59
French West Africa.....	69	55	283	23	94	95		2	194	115	15	110	688		3
Madagascar.....	57	91	1,735	1,824	62	99		41	73	69	17	50	243		
French Indo-China.....	31	12	1,992	852	663	131	3,830	2,203	2,594	1,030	46	354	1,759		1
Other French colonies.....	340	157	1,903	1,759	698	531	43	26	206	132	21	50	483	3	9
Other foreign countries.....	40	25	3,230	666	2,605	4,160	16,974	14,620	844	2,885	120	171	24,807	872	322
Total.....	2,280	1,430	28,360	34,316	101,281	113,796	163,672	149,767	44,375	58,586	1,376	7,866	181,784	2,142	805

¹ The French foreign-trade statistics, compiled by the semiofficial comité des Forges, embrace the foreign trade of the Saar.

² Figures for 1930 are not available.

Cursory examination of the table will serve to indicate the extreme importance to French metallurgy of the British, German, Belgian-Luxemburg, Swiss, and Italian markets, not to mention the French colonial outlets in North Africa, to which a considerable share of the French export shipments move. However, it should not be assumed that the French are not interested in other export markets, the list of the principal minor outlets being too long to permit of inclusion here, nor should it be assumed that they will be content to sell only in those markets indicated.

IMPORTS

France is so nearly self-sufficing in its iron and steel requirements that imports are on a very small scale compared to her exports. In 1930 imports and exports of pig iron and steel combined were in the ratio of 1 to 8. In 1931 they were in the ratio of 1 to 10.

FRENCH IMPORTS OF IRON AND STEEL PRODUCTS, 1913 AND 1928-1931

[In thousands of metric tons]

Product	1913 ¹	1928	1929	1930	1931
Foundry and puddling pig:					
Ordinary.....			9	27	10
Remelted.....	33	40	31	107	64
Ferro-alloys.....	18	19	16	32	15
Semifinished products and bars.....	23	21	56	91	92
Plates and flats.....	20	6	25	64	65
Tin plate.....	19	15	27	25	12
Pipe.....	8	9	19	21	16
Scrap.....	24	59	45	58	34
Total imports.....	145	169	228	425	308

¹ Pre-war frontiers.

² Including spiegel iron.

³ Including galvanized, leaded, etc., sheets.

This table does not include, of course, the imports of manganese ore, which were 259,000 tons in 1913, 741,000 tons in 1928, 801,000 tons in 1929, 711,000 tons in 1930, and 481,000 tons in 1931. The principal sources of supply are Russia (28.5 per cent in 1931) and British India (26.2 per cent in 1931).

REPARATIONS IN KIND

Various iron and steel products have been and are being shipped to France from Germany on reparations account under provisions of the Versailles treaty providing for that mode of payment. With the advent of the Young plan, total reparations payments were to be made on a decreasing scale from 430,900,000 marks (\$102,595,238) in 1929 to 140,800,000 marks (\$33,523,810) in 1939, after which they will cease altogether.

In the following table are shown the shipments of the various iron and steel products to France under this heading for the years 1928, 1929, 1930, and 1931. These quantities are not included in the official import totals, being reported and considered as entirely separate from that trade.

REPARATIONS IN KIND DELIVERED BY GERMANY TO FRANCE

[In metric tons]

Item	1923	1929	1930	1931
Pig iron.....	192	303	455	-----
Ferrosilicon.....	45	5	-----	-----
Ingots.....	-----	49	18	-----
Rails.....	2,062	4,207	4,588	1,796
Ties.....	-----	-----	169	6
Splice bars, fishplates, frogs and switches.....	510	1,184	719	207
Axles.....	1	14	2,088	464
Beams.....	-----	835	30	42
Bars.....	6,381	33,402	27,774	19,387
Hoops.....	1,038	720	677	47
Plates.....	214	5,220	1,180	639
Sheets (1 to 5 mm).....	36	199	663	67
Thin sheets (under 1 mm).....	49	1,468	247	54
Finished sheets.....	37	22	47	25
Galvanized sheets.....	840	-----	-----	-----
Lead-coated sheets.....	-----	67	11	-----
Corrugated iron.....	-----	383	653	54
Roll-coated wrought-iron wire.....	-----	-----	5	7
Cold-drawn wire.....	184	40	509	119
Pipes.....	401	4,808	5,440	2,804
Structural steel.....	6,874	39,516	55,217	22,485
Forgings.....	1,186	1,415	1,206	1,255
Castings.....	3,135	5,889	9,164	26,425
Barbed wire.....	-----	-----	-----	2
Wire nails.....	-----	-----	64	52
Other iron and steel products.....	4,526	25,808	57,290	36,484
Total.....	27,711	125,554	168,214	112,421
Coal.....	4,964,706	4,395,510	1,381,595	2,036,886
Coke.....	3,732,895	2,569,965	599,335	565,943
Briquettes.....	473,261	572,659	190,519	160,820

ANALYSIS OF PRODUCTION AND TRADE OF IMPORTANT PRODUCTS

Statistics descriptive of the French production, exports, and imports of the several iron and steel products commented upon herein appear elsewhere in appropriate sections of this bulletin and, except for total figures, will not be duplicated in this portion of the discussion. Where it appears desirable to supplement these comments with information as to the current import duties and/or restrictions relating to specific products, this information can be secured upon application to the Foreign Tariff Division of the Bureau of Foreign and Domestic Commerce at Washington.

PIG IRON

As commented upon in the section descriptive of production of pig iron in France, a very large proportion (89 per cent in 1931) is invariably basic Bessemer pig iron, a result of the high phosphorus content of the ores of eastern France, in which area a very large part of the domestic production is accomplished. Pig-iron exports from France, for this reason, are chiefly to those countries employing the Thomas or basic Bessemer process of steel production. Shipments in 1931 dropped to 423,000 tons—a quantity four times that exported in 1913 (101,000 tons)—with immediately neighboring countries taking all but a small proportion of the total. Imports, because of the undue proportion of the domestic production represented by phosphorus pig iron, were chiefly of hematite grade (containing less than 0.12 per cent phosphorus) and amounted to 74,000 tons in 1931, only about twice as great as in 1913 when 33,000 tons were imported. Pig-iron prices have declined steadily in France, reaching \$9.58 per ton in January, 1932.

FERRO-ALLOYS, INCLUDING SPIEGELEISEN

All of the more usual ferro-alloys are produced in France—chiefly in the center, southeast, and southwest, where cheap hydro-electric power is available. Spiegeleisen production is fairly evenly distributed in all producing regions. Production since 1913, when only 8,000 tons were made, has risen until, in 1930, a total of 237,000 tons of all kinds of ferro-alloys were produced in France. Output in 1931, however, declined to only 179,000 tons. Exports are of no great consequence and amounted to only 17,000 tons in 1931 (13,000 tons in 1913), while imports, until 1931, have been in slightly greater volume.

INGOTS, BLOOMS, BILLETS, AND SLABS

These semifinished products occupy an unusually important place in the French production and trade, domestic and foreign. This arises from the fact that there are still a number of steel plants without sufficient rolling-mill capacity to absorb their output of this class of material as well as finishing plants which do not have supporting equipment for the production of the semiproducts. There is, too, a considerable demand for material of this class in such export markets as Belgium and Great Britain, which also engage extensively in the production of finished steel (sheets and tin plate). Corroborative evidence of the position of semifinished products in the French trade is to be found in the fact that of the 7,809,000 tons of steel produced in 1931, 1,329,000 tons, or 17 per cent were sold in the form of the products under discussion. The domestic price of blooms in January, 1932, was \$14.86 per ton against an export price on billets f. o. b. Dunkirk of \$8.08 in the same month.

CASTINGS

French steel castings are very good, but a number of factors operate to keep malleable iron castings from attaining this standard. Imports of castings are negligible, although the tonnage of exports—181,784 tons in 1931—is considerable and enjoys fairly widespread distribution.

MERCHANT SHAPES

The most outstanding characteristic of French merchant shapes is that they are almost invariably rolled from Thomas steel billets. Production in 1931 amounted to only 1,927,000 tons as contrasted with an output of 2,276,000 tons in 1930, but even so, represented 24.6 per cent of the 1931 steel production. Exports of merchant shapes lead all other items; at 1,428,692 tons they amounted to 40.8 per cent of the 1930 total of exports. These products suffered less in 1931 than did most other products, for while their tonnage dropped to 1,355,328 tons, this figure represented 41.5 per cent of total exports. Imports of merchant shapes have risen rapidly in recent years, coming from 21,000 tons in 1928 to 92,000 tons in 1931. This material also figured in the deliveries of reparations-in-kind from Germany to the extent of 27,700 tons in 1930 and 19,400 tons in 1931. The average domestic price in January, 1932, for merchant shapes was unchanged at \$19.55, while the export price f. o. b. Dunkirk in that same month was \$8.97.

TIN PLATE

Before the war the French production of tin plate, then centered chiefly in the five mills situated in the Departments of Loire-Inferieure, Morbihan, Allier, Saone-et-Loire, and Oise where the old Welsh (hand-mill) method of manufacture was employed, was insufficient to supply national needs. The recovery of Alsace-Lorraine brought with it a supplementary tin-plate production, and this together with development within the original French industry increased output until in 1930 and 1931 some 90,000 tons of tin plate were being made annually. Neighboring countries, together with French colonial possessions, form the chief outlets for the tonnages exported (34,316 in 1931). Imports, chiefly from several of these same countries, amounted to 25,000 tons in 1930 and to 12,000 tons in 1931.

SHEETS

The French sheet market, with the possible exception of Belgium, is the cheapest in the world, principally because there are, in France, a number of small sheet makers who purchase their raw materials from the large manufacturers and roll only sheets. As they are in the market only when business is good, they are able, because of their low overhead, to shut down completely when the sheet trade becomes unrenumerative. Their sales appeal is solely on a price basis, and their chief outlet is among the small automobile manufacturers who, because of their low output, do not need high quality "body" sheets.

There is at present only one mill in France producing satisfactory automobile body sheets from the standpoint of finish and deep-drawing qualities. That firm, Les Forges de Chatillon-Commentry et Neuves Maisons, operates under American patents and supervision. Other plants, including the Schneider plant at Le Creusot, have attempted the manufacture of these sheets, but as late as 1930 had not succeeded in turning out an automobile body sheet which the local trade held to be satisfactory. American and German sheets compete in this market with the Eichen plant of the Vereinigte Stahlwerke and Hoesch and principal German makers represented.

The French tariff, very strangely has had little effect upon the sale of foreign-made automobile sheets in France up to the time of this writing (February, 1932). The reason is that the automobile manufacturers are able to import, under the provisions of the temporary admission regime, the same weight of unfabricated steel products as they export in their fabricated cars. That is, if a French manufacturer exports a car in which, say, 1,000 kilos of its weight is made up of steel products, he has the right to bring in 1,000 kilos of similar unfabricated material.

The practice in France of pouring small ingots (400 to 1,000 kilos) and thereby eliminating the blooming mill adversely affects the quality of the sheet bar and finished sheet. In the United States where ingot practice produces ingots weighing from 2½ to 5 or 6 tons, the sheet bars rolled from the larger ingots are carefully inspected and then pickled before passing into the sheet mill. French practice will not permit of such care, which is essential to insure a high-grade finished product. Only two mills in France (Longwy and La Chiers) roll sheets on modern mills, all others use hand mills.

The two exceptions cited installed Morgan semicontinuous mills a few years ago.

All single-pickled, deep-drawing, single-pickled extra deep-drawing, and single-pickled cold-rolled sheets used in France are bought from local mills, as they are used principally on interior work. It is only the larger consumers—automobile makers such as Citroen, Renault, and Peugeot and, to a lesser degree, Mathis and Berliet—which require the quality product, since their production is so high and prices so low that they can not afford to polish second-grade sheets by hand as do the smaller makers.

Statistics covering sheet production divide this production into two classifications—sheets of less than 5 millimeter thickness and sheets of greater thickness. Production of the larger weight sheets in 1931 totaled 585,000 tons against 743,000 tons in 1930 and 819,000 tons in 1929, while the output of the heavier sheets amounted to 310,000, 377,000, and 366,000 tons in these respective years.

Silicon sheets, made chiefly from electric steel, are locally reported of inferior quality to the imported sheet. However, imports are in negligible quantity, as are exports.

RAILS

The eastern district has been and is to-day the center of rail production in France, and, as might be expected, nearly all of the national production is of basic Bessemer steel. Rails, frogs, switches, and fishplates were all lumped together in the 1913 production reports, in which year 698,000 tons of these track materials were made. In 1931 rail production alone amounted to 392,000 tons. Rails are an important factor in the French export trade—the 281,000 tons shipped abroad in 1931 amounting to 12 per cent of the total trade of that year. Imports are in negligible amount and are almost entirely made up of reparations-in-kind deliveries from Germany. Domestic prices and sales are regulated by the rail comptoir, while the export business done falls under the direction of l'Irma, its international equivalent.

PLATES

Ordinary plates are rolled almost entirely in the north and center from open-hearth stock, while armor plate is forged by only two companies—Schneider et Cie. and Chatillon, Commentry et Neuves Maisons of the center. Exports, slightly increased in 1931, totaled 160,142 tons of ordinary and heavy plates (chiefly armor plate). Imports are negligible, even if deliveries on reparations account be included.

WIRE RODS

At this time there are only two continuous wire-rod mills in France—at the plant of the Acieries de Longwy and in that of La Chiers, both situated in the Longwy district. Almost without exception the output of these mills is from Thomas steel stock. Other French production is on hand mills and is made from a higher grade of steel. Production in 1930 amounted to 354,000 tons, but in 1931 declined to 290,000 tons. Exports, negligible in 1913, have risen sharply until a total of 163,672 tons was reached in 1930, with shipments declining to 149,767 tons in 1931.

WIRE

Wire production at this time is centered chiefly in the east and north, from which regions the supplies for a widespread wire-working industry move to all parts of the republic. The soft-wire drawing industry is important in the Departments of Haute-Marne, Doubs, and Haute-Saone. The cold drawn wire-making industry received considerable impetus during the war, so much so that local manufacture from domestic materials has made France practically independent of foreign supplies as distinguished from the pre-war situation of only two large factories, one in the Loire valley and the other at Lyons, making hard wire from imported (German) materials. Wire production in France in 1931 amounted to 167,000 tons and exports to 58,586 tons, the only importations since 1928 being on reparations account.

HOT AND COLD ROLLED STRIP

The French are now beginning to use semicontinuous mills in the production of both hot and cold rolled strip, an advance over previous methods. No figures covering production of this material are compiled, but it may be of value to note that exports reached the very considerable total of 113,800 tons in 1931, with the best market that of Great Britain.

BEAMS

French beams have two principal characteristics—production is confined almost entirely to the east, and Thomas steel is literally the only material used. Local production, which amounted to 771,000 in 1930 and to 732,000 tons in 1931, is influenced almost entirely by domestic demand, since imports including those on reparations account are very small and exports probably not much greater; at least this product is not accorded a separate classification in the returns compiled by the Comité des Forges, which would probably be the case were the tonnage shipped of much consequence.

PIPE

The term "pipe" as construed in the official French foreign trade statistics and in the semiofficial statistics of the Comité des Forges, designates steel pipe only. Cast-iron pipe, normally an important export commodity, is included in the general "castings" classifications previously discussed.

During the war all but two of the steel pipe plants in France were forced to close. Five new plants were constructed, however, chiefly by interests whose plants were then in the hands of the Germans. These new plants, with an estimated capacity of 150,000 tons per annum, added to the capacity of the plants restored after the war, now make the French pipe industry more than capable of supplying national needs. Production to the extent of 70 per cent of the national total is centered in the north, and one company, Compagnie d'Escaut et de la Meuse, is reported to have developed what is said to be a very fine continuous seamless tube mill of its own design. Unfortunately, this mill was just ready to go into operation when the French industry first came to feel seriously the effects of the international crisis in 1931.

The production of steel pipe was only 150,000 tons in 1931, declining to that figure from 208,000 tons in 1930 and 260,000 tons in 1929. Exports, which had reached a total of 74,000 tons in 1929 had declined to 38,200 tons in 1931. Imports in this same year amounted to only 16,000 tons, of which 2,804 tons were on reparations account.

TOOL STEEL

French tool steels are of very high quality; in fact, the French are strong in all branches of metallurgy where, to attain high quality, scientific and research ability is required. Unfortunately, production statistics are not available, while export figures were separately compiled only for 1931 when 1,376 tons of this special material were exported.

OTHER PRODUCTS

The production of special steels in France, for which no output data are developed, has attained considerable importance. Exports in 1931 amounted to 2,142 tons, with Italy an important outlet.

Machine steel—soft steel of quite different characteristics from the special and tool steels mentioned above—is characteristically a product of the eastern district of France. Unfortunately, however, no production or export statistics are compiled, leaving the exact size and importance of the material unknown.

Forgings, for which likewise no statistics are available, are made in the center and north, which manufacture them to the exclusion of all other regions.

THE SAAR

By virtue of the treaty of Versailles the territory of the Saar, located between the southwestern tip of Germany and Lorraine in France, is under French administration and will remain so until 1935, when a plebiscite will be held to decide whether the territory will revert to Germany or become permanently French. Although only 730 square miles in extent, of no political consequence as a unit, and of no particular importance because of its geographical location, the Saar nevertheless is of great economic value to whichever country controls it. The immensely rich coal deposits within its confines and its proximity to rich ore deposits make its final disposition of great importance.

There are five centers of iron and steel making activity in the Saar—Burbach, Neunkirchen, Dillingen, Halberg, and Voelklingen. This industry, which normally employs upwards of 50,000 of the 160,000 laborers of the territory, dates back to 1685, when a concession to establish an iron foundry at Dillingen was granted by Louis XIV to the Marquis de Lenoncourt-Blainville. The Société des Forges et Aciéries de Dillingen is a direct descendent of this first grant.

In 1913 the production of pig iron in the territory amounted to 1,371,000 metric tons and that of steel ingots to 2,080,000 tons. Since the war the production of pig iron has steadily increased (to 1,912,000 tons in 1930), although steel production decreased slightly from 2,080,000 tons in 1913 to 1,936,000 tons in 1930, dropping to 1,515,000 tons in 1931. The production of pig iron in the Saar is greatly affected—as is the eastern French iron and steel region, of which it forms an economic part—by the relatively poor coking qualities of its coking coal, which, however, is of a somewhat better grade than that mined in most of the east of France.

Statistics of the production of the Saar in recent years contrasted with 1913 follow.

COAL, IRON, AND STEEL PRODUCTION IN THE SAAR, PRE-WAR AND 1928-1931

[In thousands of metric tons]

Products	1913	1928	1929	1930	1931
Coal.....	13, 216	13, 107	13, 579	13, 236	11, 364
Pig iron, total.....	1, 371	2, 105	2, 200	1, 936	1, 515
Basic Bessemer.....	1, 223	1, 728	1, 898	1, 691	1, 351
Foundry pig.....	148	309	307	243	164
Raw steel, total.....	2, 080	2, 072	2, 208	1, 936	1, 538
Ingots.....					
Basic Bessemer.....	1, 719	1, 561	1, 642	1, 456	1, 116
Open-hearth and electric.....	356	492	544	480	407
Castings.....	5	19	22	24	15
Semifinished products.....	156	174	157	168	135

¹ Only principal grades shown.

PRODUCTION OF PRINCIPAL FINISHED PRODUCTS, PRE-WAR AND 1928-1931

[In thousands of metric tons]

Product	1913	1928	1929	1930	1931
Rails, frogs, fishplates, switches.....	332	211	230	205	152
Beams.....	303	283	252	198	147
Wire rod.....	116	169	157	145	133
Sheets.....	38	123	120	99	76
Pipe.....	75	86	84	53	42
Plates, thin.....	93	94	97	95	93
Plates, heavy.....	55	89	161	165	109
Merchant shapes.....	482	483	497	447	354
Total.....	1,494	1,537	1,598	1,407	1,106

THE FIVE CENTERS OF PRODUCTION IN THE SAAR

BURBACH

At this center the principal concern is that of Aciéries Réunies de Burbach-Eich-Dudelange S. A., commonly called "Arbed," a Luxemburg company employing 8,000 workmen. Before the war the production of the blast furnaces at Burbach was 400,000 tons, while in 1928 it amounted to 550,000 tons. With the dismantling of three furnaces and the modernization of the other five belonging to this company, the production capacity will remain at about the 1928 figure, but costs will be considerably reduced. Accessory equipment at Burbach has also been improved. Two blowing machines with a capacity of 2,100 cubic meters per minute have been installed, while a purifier of 50,000 cubic meters capacity per hour is under construction. The recuperative coke ovens, numbering 360, with a monthly capacity of 58,000 tons, were increased by 40 during 1931. Six thousand tons of ammonium sulphate, 8,000 tons of benzol, and 25,000 tons of tar are produced annually as by-products when the plant is operating at capacity.

All services connected with the works have been reorganized in addition to the above. All of the blast-furnace gas is now utilized, whether in the preheaters, to drive the blowing engines, or otherwise. The coke-oven gas is sold to a public utility. Rolling mills and warehouses have been rearranged so as to permit a continuity of service, which is accomplished almost entirely by electric traction. Two high-pressure electric generators were installed in 1928 and a third was added in 1931. With the installation of an up-to-date rolling mill, now under way, the "Arbed" plant will be completely modernized.

NEUNKIRCHEN

The principal steel works at Neunkirchen is that of the "Neunkircher Eisenwerk," formerly Stumm Bros., which employs about 6,000. As at Burbach, the blast furnaces have been modernized, the capacity of the blowing machines increased, automatic chargers installed, and pulverizers erected for reducing Thomas scoriæ. Five of the six furnaces have already been transformed, with work under way on the sixth. Through these improvements the pig-iron capacity of this plant will be 50,000 tons monthly, the increase in the production of pig iron making additional coke ovens necessary. Twenty were put into service in 1928 and another battery of 20 in February,

1930, thus assuring, with those previously in operation, a monthly output of 60,000 tons of coke. Much attention is given to the recovery of the by-products of coke manufacture at Neunkirchen, and installations have been made for the distillation of tar. Through the concentration and coordination of labor at this plant the number of employees has been reduced while capacity has been increased.

DILLINGEN

The Soc. Anon. des Forges de Dillingen employs between 6,000 and 6,500 men. This company, making it its policy to manufacture a product which would find a ready market, previous to and during the war specialized in armor plate, with the production of bars as a secondary feature. When a change in policy became necessary, the management decided upon the production of galvanized sheets and plates, paying particular attention to boiler plate.

HALBERG

Steel and iron pipe are the principal items in the production of the plant at Halberg (Halberger Hutte, G. m. b. H.). At this plant the old-type blast furnaces have been retained, innovations being limited to the erection of one new furnace. This additional unit necessitated the installation of a new and larger coal washer and the construction of another battery of coke ovens. A pipe and fittings foundry and a 200-ton capacity cement mill were added in 1930.

VOELKLINGEN

The principal concern at Voelklingen is Roechling (Edelstahlwerk Roechling A. G.), employing about 7,000 workers. In the effort to adjust itself to postwar conditions the company made a complete renovation of its plant. The coke-oven plant was transformed, not to produce more but rather better coke—the cinder content, it is claimed, being reduced from 12 to 8 per cent.

Here, as at the other plants in the Saar, increasing attention is paid to the recovery of blast-furnace and coke-oven by-products, while new uses are being sought for the furnace residues. One development has been the erection of a cement mill, and promising experiments have been made in making slag paving blocks. Excess gas production is sold to public utilities, and, to provide for future long-distance gas distribution, a 60,000-meter tank was installed in 1930, while a second tank with a capacity of 100,000 meters is under construction. This will be the largest gas storage tank in the territory. The electric plant of the works, formerly operated by coal, will shortly be gas operated.

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