Iron and Steel

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DURING 1962, the U.S. steel industry operated at about the same level of volume as during 1960 and 1961. Total production of pig iron was up 1.2 percent, and total steel production increased by 0.3 percent. Output was uninterrupted by strikes, but the possibility of a strike in mid-1963 caused some extra buying and kept production volume during the last quarter of 1962 at a higher level than required by consumption demands.

Advances in technology rapidly accelerated the production of steel products from ore. Changes in technology, including the increased use of agglomerated products of higher iron content; injection of gas, oil, and coal; use of higher blast temperatures and higher top pressures; and oxygen enrichment of the blast increased the rate of iron production from the blast furnace. In large oxygen converters, steelmaking rates of over 300 tons per hour were achieved in normal commercial operation, while the use of oxygen in lances and for flame enrichment resulted in production rates of over 100 tons per hour in open-hearth furnaces. Continuous- and pressure-casting techniques promised to decrease the time from molten steel to rolled products.

Shipments of steel products, all grades including exports, totaled 70.6 million tons, compared with 66.1 million tons in 1961. Nearly all consuming industries bought more steel than in 1961. The automotive industry, the major consumer, consumed most of the increase in shipments, taking 15.2 million tons in 1962 (22 percent of the total domestic shipments), contrasted with 12.6 million tons in 1961 (20 percent of the total domestic shipments).

Imports of major iron and steel products totaled 4.3 million tons, compared with 3.3 million tons in 1961 and 4.6 million tons in the peak year 1959. The European Coal and Steel Community and Japan supplied 50.5 and 26.5 percent, respectively, of the imports. Exports were 2.3 million tons, up slightly from the 1961 total of 2.2 million tons.

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No general increase in steel prices occurred, although average hourly labor costs increased. According to the American Iron and Steel Institute (AISI), the 1962 payroll of the steel industry was $3.8 billion, compared with $3.6 billion in 1961. The net billing value of products shipped and other services was $13.8 billion, compared with $13.1 billion in 1961. Net income was $567 million, the lowest since 1952, and 17.8 percent lower than in 1961.

TABLE 1.—Salient iron and steel statistics

(Thousand short tons)

	1953–57 (average)	1958	1959	1960	1961	1962
United States:						
Pig iron:						
Production	72,617	57,155	60,210	66,501	64,853	65,638
Shipments	72,249	56,918	61,245	65,612	65,307	65,727
Imports for consumption	343	210	700	331	377	500
Exports	243	103	10	112	416	154
Steel: [1]						
Production of ingots and castings (all grades):						
Carbon	99,494	78,591	84,539	90,864	89,339	89,162
Stainless	1,086	896	1,131	1,004	1,137	1,085
All other alloy	8,398	5,768	7,776	7,414	7,538	8,081
Total	108,978	85,255	93,446	99,282	98,014	98,328
Capacity, annual, Jan. 1	125,905	140,743	147,634	148,571	[2]	[2]
Percent of capacity	86.6	60.6	63.3	66.8	[2]	[2]
Index (1953–57=100)	100.0	78.2	85.7	91.1	89.9	90.2
Total shipments of steel mill products	78,234	59,914	69,377	71,149	66,126	70,552
Imports of major iron and steel products [3] [4]	1,292	1,820	4,615	3,570	3,308	4,291
Exports of major iron and steel products	4,302	3,225	1,973	3,247	[5] 2,221	2,267
World production:						
Pig iron [6]	205,530	216,750	247,100	[5] 285,100	[5] 287,350	294,200
Steel ingots and castings	287,550	[5] 298,300	[5] 336,250	[5] 381,200	[5] 390,400	397,350

[1] American Iron and Steel Institute.
[2] Data not available.
[3] Data not comparable for all years.
[4] Bureau of the Census.
[5] Revised figure.
[6] Includes ferroalloys.

PRODUCTION AND SHIPMENTS OF PIG IRON

U.S. production of pig iron was 1 percent higher than in 1961, but it was 10 percent below the 1953–57 5-year average. The number of operating blast furnaces decreased from 172 at the beginning of 1962 to 138 at yearend. According to the AISI the average production of pig iron per blast-furnace day was 1,349.4 tons, compared with 1,305.4 tons in 1961 and 1,181.5 tons in 1960. Pig iron production increased in most parts of the Nation, but decreased slightly in the South and sharply in the West. Pennsylvania, Ohio, and Indiana continued to be the major producers, supplying 24, 18, and 13 percent, respectively, of the pig iron produced.

The number of blast furnaces in the United States was 247, 12 less than in 1961. Six of the 12 were abandoned, and the other 6 were being dismantled. Two new blast furnaces were under construction, one at Ashland, Ky., for Armco Steel Corp. and the other at Cleveland, Ohio, for Jones & Laughlin Steel Corp.

Metalliferous Materials Consumed in Blast Furnaces.—A total of 102.5 million tons of ores and agglomerates, 3.4 million tons of scrap, and 6.7 million tons of miscellaneous materials were consumed in making pig iron in 1962. The combined net charge was 1.715 tons per ton of pig iron produced, compared with 1.728 tons per ton of pig iron in 1961. Consumption of miscellaneous materials consisted of 3,087,427 tons of mill cinder and roll scale, 3,382,385 tons of open-hearth and Bessemer slag, and 212,362 tons of other materials.

The agglomerate charge consisted of 36,649,719 tons of sinter; 10,106,526 tons of self-fluxing sinter, 15,311,710 tons of pellets, 191,275 tons of nodules, and 206,007 tons of unclassified agglomerates, plus 948,335 tons of agglomerates from foreign sources. Canada, Venezuela, and Chile were the major sources for the foreign iron ore and manganiferous iron ore consumed in U.S. blast furnaces.

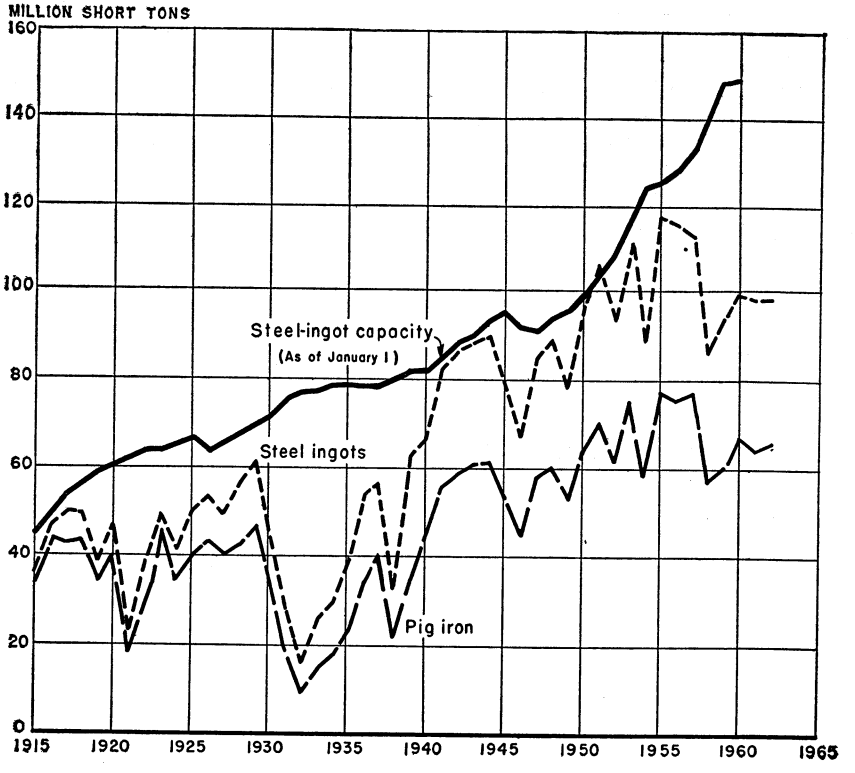

FIGURE 1.—Trends in production of pig iron and steel ingots, 1915-62, and steel-ingot capacity in the United States, 1915–60.

TABLE 2.—Pig iron produced and shipped in the United States, by States

(Thousand short tons and thousand dollars)

State	Produced		Shipped from furnaces			
	1961	1962	1961		1962	
	Quantity		Quantity	Value	Quantity	Value
Alabama	3,531	3,628	3,585	$202,946	3,595	$206,565
Illinois	4,725	4,715	4,775	288,469	4,775	282,210
Indiana	8,877	8,817	8,865	522,733	8,796	504,326
Ohio	10,984	11,548	11,007	669,033	11,470	686,860
Pennsylvania	15,205	15,726	15,272	908,363	15,886	936,184
California, Colorado, Utah	4,657	3,708	4,700	237,348	3,719	191,866
Kentucky, Tennessee, Texas	1,689	1,499	1,723	97,247	1,507	81,396
Maryland and West Virginia	6,418	6,650	6,493	397,606	6,608	391,136
Michigan and Minnesota	5,005	5,432	5,059	267,726	5,415	307,634
New York	3,762	3,915	3,828	229,890	3,956	233,962
Total	64,853	65,638	65,307	3,821,361	65,727	3,822,139

According to the AISI, 11.4 billion cubic feet of oxygen was used in blast furnaces, compared with 8.9 billion cubic feet in 1961 and 4.4 billion cubic feet in 1960. Data collected by the Bureau of Mines showed that 39.2 billion cubic feet of natural gas, 3.8 billion cubic feet of coke-oven gas, and 7.4 million gallons of oil were injected through the tuyères of blast furnaces in the United States.

TABLE 3.—Foreign iron ore and manganiferous iron ore consumed in manufacturing pig iron in the United States, by sources of ore

(Short tons)

Source	1961	1962 [1]	Source	1961	1962 [1]
Brazil	32,546	91,804	Venezuela	4,175,675	4,299,230
Canada	4,107,871	4,652,643	Other countries	115,863	133,772
Chile	1,026,282	1,117,112			
Peru	633,931	363,348	Total	10,092,168	10,657,909

[1] Excludes 17,514,110 tons used in making agglomerates.

TABLE 4.—Pig iron shipped from blast furnaces in the United States, by grades [1]

(Thousand short tons and thousand dollars)

Grade	1961			1962		
	Quantity	Value		Quantity	Value	
		Total	Average per ton		Total	Average per ton
Foundry	1,402	$83,856	$59.81	1,398	$82,304	$58.87
Basic	58,601	3,413,110	58.24	58,919	3,412,990	57.93
Bessemer	2,641	160,518	60.78	2,764	166,105	60.10
Low-phosphorus	207	13,561	65.51	171	10,846	63.43
Malleable	2,213	137,844	62.29	2,295	140,550	61.24
All other (not ferroalloys)	243	12,472	51.33	180	9,344	51.91
Total	65,307	3,821,361	58.51	65,727	3,822,139	58.15

[1] Includes pig iron transferred directly to steel furnaces at same site.

TABLE 5.—Number of blast furnaces (including ferroalloy blast furnaces) in the United States, by States

State	January 1, 1962			January 1, 1963		
	In blast	Out of blast	Total	In blast	Out of blast	Total
Alabama	10	12	22	11	10	21
California	4	----------	4	3	1	4
Colorado	3	1	4	3	1	4
Illinois	14	8	22	11	11	22
Indiana	19	4	23	17	6	23
Kentucky	2	1	3	2	----------	2
Maryland	10	----------	10	6	4	10
Michigan	9	----------	9	9	----------	9
Minnesota	1	2	3	1	1	2
New York	13	4	17	9	8	17
Ohio	29	21	50	25	24	49
Pennsylvania	46	29	75	33	35	68
Tennessee	1	2	3	1	2	3
Texas	2	----------	2	2	----------	2
Utah	4	1	5	2	3	5
Virginia	1	1	2	----------	2	2
West Virginia	4	1	5	3	1	4
Total	172	87	259	138	109	247

Source: American Iron and Steel Institute.

TABLE 6.—Iron ore and other metallic materials, coke and fluxes consumed and pig iron produced in the United States, by States

(Short tons)

Year and State	Metalliferous materials consumed							Net coke	Fluxes	Pig iron produced	Metalliferous materials consumed per ton of pig iron made				Coke and fluxes consumed per ton of pig iron	
	Iron and manganiferous ores		Agglomerates	Net ores and agglomerates [1]	Net scrap [2]	Miscellaneous [3]	Net total				Net ores and agglomerates [1]	Net scrap [2]	Miscellaneous [3]	Total	Net coke	Fluxes
	Domestic	Foreign														
1961:																
Alabama	3,882,466	568,796	2,544,007	6,770,800	166,243	40,387	6,977,430	3,269,210	976,522	3,531,259	1.917	0.047	0.011	1.975	0.926	0.277
Illinois	3,744,386		4,237,649	7,622,930	264,687	546,635	8,434,252	3,528,673	995,013	4,725,149	1.613	.056	.116	1.785	.747	.211
Indiana	4,940,813	453,764	9,346,618	14,213,899	129,564	1,300,087	15,643,550	5,790,429	1,267,459	8,876,721	1.601	.015	.146	1.762	.652	.143
Ohio	7,088,492	1,724,955	8,577,942	16,637,884	671,941	1,155,755	18,465,580	8,089,270	2,848,371	10,984,279	1.515	.061	.105	1.681	.736	.259
Pennsylvania	5,652,054	2,995,887	14,628,877	22,413,958	965,908	2,064,630	25,444,496	10,600,071	3,182,827	15,204,824	1.474	.064	.136	1.674	.697	.209
California, Colorado, Utah	[4]	[4]	3,706,911	8,373,454	78,550	108,065	8,560,069	3,006,754	752,656	4,656,696	1.798	.017	.023	1.838	.646	.162
Kentucky, Tennessee, Texas	506,971	329,724	1,708,896	2,640,333	101,735	245,426	2,987,494	1,188,165	427,931	1,689,353	1.563	.060	.145	1.768	.703	.253
Maryland and West Virginia	[4]	[4]	6,355,084	9,769,063	167,627	654,810	10,591,500	4,390,500	874,675	6,418,333	1.522	.026	.102	1.650	.684	.136
Michigan and Minnesota	[4]	[4]	5,198,835	8,199,403	164,007	221,874	8,585,284	3,219,402	1,166,763	5,004,685	1.638	.033	.044	1.715	.643	.233
New York	1,780,301	314,416	4,080,013	5,945,525	175,547	241,860	6,362,932	2,761,167	1,095,696	3,761,427	1.581	.047	.064	1.692	.734	.291
Total	35,972,636	10,092,168	60,384,832	102,587,249	2,885,809	6,579,529	112,052,587	45,843,641	[5]13,587,913	64,852,726	1.582	.045	.101	1.728	.707	.210

1962:																
Alabama	3,697,017	748,471	2,711,811	6,985,348	120,462	123,439	7,229,249	3,215,390	930,027	3,628,060	1.925	.033	.034	1.992	.886	.256
Illinois	3,603,758	(4)	4,222,202	7,533,847	280,962	604,221	8,419,030	3,540,610	947,136	4,715,200	1.598	.060	.128	1.786	.751	.201
Indiana	5,048,076	886,883	8,502,704	13,783,844	59,861	1,426,294	15,269,999	5,775,139	1,262,642	8,816,526	1.563	.007	.162	1.732	.655	.143
Ohio	5,625,619	1,923,772	10,445,052	17,229,531	861,265	1,266,226	19,357,022	8,185,856	2,976,021	11,547,845	1.492	.074	.110	1.676	.709	.258
Pennsylvania	5,066,984	2,345,637	16,270,271	22,943,918	946,298	2,009,737	25,899,953	10,763,289	2,682,734	15,725,819	1.459	.060	.128	1.647	.684	.171
California, Colorado, Utah	(4)	(4)	3,104,467	6,770,470	494,582	103,291	7,368,343	2,350,123	628,964	3,707,880	1.826	.133	.028	1.987	.634	.170
Kentucky, Tennessee, Texas	538,569	363,309	1,530,072	2,393,757	116,922	133,654	2,644,333	768,030	328,205	1,498,471	1.597	.078	.089	1.764	.513	.219
Maryland and West Virginia	(4)	(4)	6,437,769	10,134,669	167,094	559,817	10,861,580	4,386,140	885,911	6,650,302	1.524	.025	.084	1.633	.660	.133
Michigan and Minnesota	(4)	(4)	5,925,960	8,635,490	216,942	211,959	9,064,391	3,532,664	1,234,232	5,432,269	1.590	.040	.039	1.669	.650	.227
New York	1,725,440	352,494	4,263,264	6,109,912	117,349	243,536	6,470,797	2,725,353	1,003,797	3,915,160	1.561	.030	.062	1.653	.696	.256
Total	32,291,374	10,657,909	63,413,572	102,520,786	3,381,737	6,682,174	112,584,697	45,242,594	[6] 12,879,669	65,637,532	1.562	.051	.102	1.715	.689	.196

[1] Net ores and agglomerates equal ores plus agglomerates plus flue dust used minus flue dust recovered.
[2] Excludes home scrap produced at blast furnaces.
[3] Does not include recycled material.
[4] Included in total.
[5] Fluxes consisted of 9,401,285 tons of limestone and 4,186,628 tons of dolomite, excluding 4,533,355 tons of limestone and 1,421,140 tons of dolomite used in agglomerate production at or near steel plants and an unknown quantity used in making agglomerates at mines.
[6] Fluxes consisted of 9,100,454 tons of limestone and 3,779,215 tons of dolomite, excluding 4,424,975 tons of limestone and 1,629,284 tons of dolomite used in agglomerate production at or near steel plants and an unknown quantity used in making agglomerates at mines.

PRODUCTION AND SHIPMENTS OF STEEL

Production of steel in the United States was 98,328 short tons, an increase of less than 1 percent over 1961. Steel castings made by independent foundries, not included in the production figure, totaled 1,244,509 tons, compared with 1,078,182 tons in 1961. Of the total steel produced, 84.4 percent was made in open-hearth furnaces, 9.2 percent in electric furnaces, 5.6 percent in basic oxygen converters, and 0.8 percent in Bessemer converters. Corresponding percentages for 1961 were 86.2, 8.8, 4.1, and 0.9. Pennsylvania continued to be the major U.S. steel producer, followed by Ohio, Indiana, and Illinois, in descending order. Percentages of total production were Pennsylvania, 23.3; Ohio, 17.1; Indiana, 14.3; and Illinois, 8.8.

Shipments of steel products increased 4.4 million tons over 1961 shipments. More than one-half of the increase was due to a 21 percent increase in shipments for automotive uses, and the remainder of the increase occurred mainly in the rail transportation and machinery categories.

Alloy Steel.[3]—Alloy steel production, excluding stainless, was 8,080,310 tons, including 48,064 tons of alloy steel for castings, an increase of 7 percent over 1961 production. Total stainless steel production was 1,085,271 tons, including 1,272 tons of steel for castings, 5 percent less than in 1961. Production of the manganese-nickel-chromium AISI 200 series reached a record at 39,105 tons, nearly 23 percent more than in 1961, the previous record year. Production of AISI 300 series stainless steel and related nickel-chromium alloys was 661,361 tons, a drop of 7 percent from 1961 production.

Of the total alloy steel production (including stainless), 58.8 percent was produced in the open hearth, 40.7 percent in the electric furnace, and 0.5 percent by the basic oxygen process.

Total output of carbon steel was 89,162,204 tons, compared with 89,339,766 tons in 1961.

Materials Used in Steelmaking.—Consumption of pig iron and scrap for steelmaking totaled 110.2 million tons. Pig iron made up 55 percent of the total, the same percentage as in 1961. Consumption of ore decreased 8 percent to 6,643 tons. Foreign ore comprised 72 percent of the total ore used. According to the AISI, 211,467 tons of fluorspar, 4,750,508 tons of limestone, 1,493,195 tons of lime, and 527,173 tons of other fluxes were consumed in steelmaking. Total consumption of oxygen in steelmaking was 54,675 million cubic feet, 23.8 percent more than in 1961. Approximately 77 percent of the total oxygen

[3] The Bureau of Mines uses the American Iron and Steel Institute specifications for alloy steels, which include stainless and any other steel containing one or more of the following elements in the designated percentages: Manganese in excess of 1.65 percent, silicon in excess of 0.60 percent, and copper in excess of 0.60 percent. It also includes steel containing the following elements in any quantity specified or known to have been added to obtain a desired alloying effect: Aluminum, boron, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, and other alloying elements.

Stainless steel includes all grades of steel that contain 10 percent or more of chromium with or without other alloys or a minimum combined content of 18 percent of chromium and other alloys. Valve or bearing steels, high-temperature alloys, or electrical grades with analyses meeting the definition for stainless steels are included. All tool-steel grades are excluded.

Heat-resisting steel includes all steel containing 4 percent or more but less than 10 percent of chromium (excluding tool-steel grades).

consumed in steelmaking was used in open-hearth furnaces, and only 20 percent was used in basic oxygen converters.

TABLE 7.—Steel production in the United States, by type of furnace [1]

(Thousand short tons)

Year	Open hearth		Bessemer	Basic oxygen process	Electric [2]	Total
	Basic	Acid				
1953–57 (average)	97,550	582	3,085	[3] 224	7,537	108,978
1958	75,502	378	1,396	1,323	6,656	85,255
1959	81,225	444	1,380	1,864	8,533	93,446
1960	85,964	404	1,189	3,346	8,379	99,282
1961	84,108	394	881	3,967	8,664	98,014
1962	82,578	379	805	5,553	9,013	98,328

[1] Includes only that steel for castings produced in foundries operated by companies manufacturing stee ingots. Omits about 2 percent of total steel production.
[2] Includes crucible, oxygen converter steel, 1953–55.
[3] Data for 2-year period only.

Source: American Iron and Steel Institute.

CONSUMPTION OF PIG IRON

Domestic consumption of pig iron increased by 1 percent in 1962. Consumption was centered in the East, North Central, and Middle Atlantic States, which took 76 percent of the total.

TABLE 8.—Metalliferous materials consumed in steel furnaces in the United States

(Thousand short tons)

Year	Iron ore		Agglomerates [1]	Pig iron	Ferroalloys [2]	Iron and steel scrap
	Domestic	Foreign				
1953–57 (average)	3,277	4,410	1,633	64,132	1,540	57,196
1958	2,092	4,742	1,261	51,299	1,115	43,024
1959	1,690	5,238	961	54,699	1,380	49,794
1960	1,570	6,251	931	60,092	1,395	51,140
1961	1,913	5,277	855	59,418	1,367	49,455
1962	1,875	4,768	[3] 1,176	60,561	1,408	49,606

[1] Includes consumption of pig iron and scrap by ingot producers and iron and steel foundries.
[2] Includes ferromanganese, spiegeleisen, silicomanganese, manganese briquets, manganese metal, ferrosilicon, ferrochromium alloys, and ferromolybdenum.
[3] Includes 20,039 tons of sinter, 342,466 tons of pellets, 276,632 tons of nodules, 702 tons of briquets, 3,661 tons of other agglomerates. (532,031 tons of foreign origin.) 1958–61 see Iron and Steel chapter, Minerals Yearbook, v. I, p. 691.

TABLE 9.—Consumption of pig iron in the United States, by type of furnace

Type of furnace or equipment	1961		1962	
	Thousand short tons	Percent of total	Thousand short tons	Percent of total
Open hearth	54,611	83.0	54,509	81.8
Bessemer	976	1.5	792	1.2
Oxygen converter	3,552	5.4	5,020	7.5
Electric [1]	279	.4	240	.4
Cupola	3,438	5.2	3,402	5.1
Air	178	.3	186	.3
Direct castings	2,763	4.2	2,446	3.7
Total	65,797	100.0	66,595	100.0

[1] Includes a small quantity of pig iron consumed in crucible furnaces.

TABLE 10.—Consumption of pig iron in the United States, by districts and States

(Short tons)

District and State	1961	1962	District and State	1961	1962
New England:			South Atlantic—Con.		
Connecticut	29,410	33,024	North Carolina	27,971	29,457
Maine and New Hampshire	4,136	2,251	South Carolina	15,882	18,684
Massachusetts	63,281	59,876	Virginia and West Virginia	2,143,204	1,950,305
Rhode Island	36,958	41,836	Total	6,617,408	6,812,179
Vermont	8,038	7,288			
Total	141,823	144,275	East South Central:		
			Alabama	3,222,653	3,104,152
Middle Atlantic:			Kentucky, Mississippi, Tennessee	907,614	852,388
New Jersey	144,530	119,757	Total	4,130,267	3,956,540
New York	3,219,625	3,355,305			
Pennsylvania	15,315,543	15,975,716	West South Central:		
Total	18,679,698	19,450,778	Arkansas, Louisiana, Oklahoma	7,749	8,302
			Texas	856,118	780,226
East North Central:			Total	863,867	788,528
Illinois	4,975,379	4,932,854			
Indiana	9,075,150	8,972,216	Rocky Mountain:		
Michigan	5,159,290	5,534,555	Arizona and Nevada	88	162
Ohio	10,937,800	11,430,509	Colorado, Idaho, Montana, Utah	2,351,978	2,012,961
Wisconsin	175,747	186,327	Total	2,352,066	2,013,123
Total	30,323,366	31,056,461			
			Pacific Coast:		
West North Central:			California and Hawaii [1]	2,191,936	1,817,823
Iowa	69,451	71,050	Oregon and Washington	3,720	3,810
Kansas and Nebraska	5,706	5,337	Total	2,195,656	1,821,633
Minnesota	393,744	446,331			
Missouri	24,246	29,247	Grand total	65,797,298	66,595,482
Total	493,147	551,965			
South Atlantic:					
Delaware and Maryland	4,418,830	4,802,288			
Florida and Georgia	11,521	11,445			

[1] Hawaii included in 1962 figure only.

PRICES

Pig iron and steel prices remained fairly constant during 1962. The average composite pig iron price, published by Iron Age, was $58.86 per short ton, compared with $59.32 in 1961. The Iron Age figure for the composite price of finished steel was 6.196 cents per pound, unchanged since 1959.

TABLE 11.—Average value of pig iron at blast furnaces in the United States, by States

(Per short ton)

State	1953–57 (average)	1958	1959	1960	1961	1962
Alabama	$49.17	$55.14	$56.81	$56.52	$56.62	$57.46
California, Colorado, Utah	52.94	57.53	60.47	59.73	50.50	51.59
Illinois	52.86	61.32	60.12	60.30	60.42	59.10
Indiana	52.45	58.41	58.82	58.90	58.96	57.34
New York	54.32	64.48	61.01	62.54	60.05	59.13
Ohio	51.29	57.93	59.50	57.79	60.78	59.89
Pennsylvania	53.52	62.45	59.84	60.12	59.48	58.93
Other States [1]	53.07	60.53	58.38	58.06	57.44	57.66
Average	52.58	59.60	59.33	59.53	58.51	58.15

[1] Comprises Kentucky, Maryland, Michigan, Minnesota, Tennessee, Texas, West Virginia, and Massachusetts (1953–60).

TABLE 12.—Average prices of chief grades of pig iron

(Per short ton)

Month	Foundry pig iron at Birmingham furnaces 1962	Foundry pig iron at Valley furnaces 1962	Bessemer pig iron at Valley furnaces 1962	Basic pig iron at Valley furnaces 1962
January–December	55.39	58.93	59.38	58.48

Source: Metal Statistics.

TABLE 13.—Free-on-board value of steel mill products in the United States, in 1961 [1]

(Cents per pound)

Product	Carbon	Alloy	Stainless	Average
Ingots	4.038	10.066	32.067	9.371
Semifinished shapes and forms	5.278	10.435	36.234	6.380
Plates	6.612	11.048	59.964	7.398
Sheets and strips	7.074	15.616	49.977	8.023
Tin mill products	9.106			9.106
Structural shapes and piling	6.394	[2]		6.394
Bars	7.580	13.466	65.443	9.170
Rails and railway-track material	8.499			8.499
Pipes and tubes	14.944	19.098	158.165	18.707
Wire and wire products	13.045	38.557	84.702	14.009
Other rolled and drawn products	[3]	42.117	59.820	45.026
Average total steel	7.602	14.283	57.752	8.560

[1] This table represents the weighted average value based on the quantity of each type of steel shipped; therefore, it reflects shifts in the distribution of the 3 classes of steel.
[2] Included with "Plates."
[3] Included with "Rails and railway-track material."

Source: Computed from figures supplied by the U.S. Department of Commerce, Bureau of the Census.

FOREIGN TRADE [4]

For the fourth consecutive year, imports of steel mill products exceeded exports. Imports were 232 percent higher than the 1953–57

[4] Figures on imports and exports compiled by Mae B. Price and Elsie D. Jackson, Division of Foreign Activities, Bureau of Mines, from records of the U.S. Department of Commerce, Bureau of the Census.

5-year average, and exports were only 53 percent of the 1953–57 average.

Imports.—Imports of iron and steel products totaled 4.3 million tons, the second highest total on record and 30 percent higher than the total for 1961. The bulk of the imports were supplied by the European Coal and Steel Community and Japan. Imports of pig iron (77 percent from Canada) were 500,010 tons, 33 percent higher than in 1961.

Exports.—Exports of iron and steel products totaled 2.3 million tons, slightly higher than in 1961. Exports of pig iron (55 percent to Japan) were 154,380 tons, compared with 415,668 tons in 1961.

TABLE 14.—U.S. imports for consumption of pig iron, by countries

(Short tons)

Country	1953–57 (average)	1958	1959	1960	1961	1962
North America: Canada	258,717	182,128	437,095	281,593	349,403	386,232
South America: Brazil	3,924	2				
Europe:						
Belgium-Luxembourg				4,408		
Finland	34		10,253			681
Germany, West	7,085	13,933	[1] 71,805	386	719	56,341
Netherlands	5,547	1,125	4,427	1,575		
Norway	1,347	334	168			3,584
Portugal			4,395			
Spain	3,874	7,867	78,499	21,551	19,113	42,416
Sweden	13,058	1,615	1,071	1,445	1,201	1,416
U.S.S.R.			1,550	1,298	396	
United Kingdom			51			94
Total	30,945	24,874	172,219	30,663	21,429	104,532
Asia:						
India	6,336		56	6,742		
Japan			10,674			
Total	6,336		10,730	6,742		
Africa:						
Rhodesia and Nyasaland, Federation of [2]	1,758		4,863	392		
South Africa, Republic of [3]	1,414		70,519	7,543	4,096	5,030
Total	3,172		75,382	7,935	4,096	5,030
Oceania: Australia	40,143	2,739	4,167	3,914	2,252	4,216
Grand total:						
Short tons	343,237	209,743	699,593	330,847	377,180	500,010
Value	$17,043,294	$12,026,015	$35,493,259	$18,351,333	$20,511,391	$24,681,598

[1] Includes 110 tons from East Germany.
[2] Classified as Southern Rhodesia through June 30, 1954; 1,562 short tons was produced from January through June 1954.
[3] Effective Jan. 1, 1962, formerly Union of South Africa.

Source: Bureau of the Census.

TABLE 15.—U.S. imports for consumption of major iron and steel products

Products	1961		1962	
	Short tons	Value	Short tons	Value
Iron products:				
Bar iron, iron slabs, blooms, or other forms	60	$18,971	211	$64,710
Pipes and fittings:				
Cast-iron pipe and fittings	[1] 21,932	[1] 2,438,665	35,540	4,043,946
Malleable cast-iron pipe fittings	2,300	917,052	3,325	1,304,389
Castings and forgings	[1] 6,865	[1] 2,419,492	15,056	5,220,909
Total	31,157	[1] 5,794,180	54,132	10,633,954
Steel products:				
Steel bars:				
Concrete reinforcement bars	582,807	48,468,456	607,024	44,284,929
Solid and hollow, n.e.s.	112,663	14,276,382	126,358	17,009,912
Hollow and hollow drill steel	1,486	631,019	2,567	1,188,238
Wire rods, nail rods, and flat rods up to 6 inches in width	451,209	59,015,135	644,594	62,049,125
Boiler and other plate iron and steel, n.e.s.	71,045	8,407,821	216,069	26,319,439
Steel ingots, blooms, and slabs; billets, solid and hollow	178,915	12,536,560	170,605	13,323,271
Die blocks or blanks, shafting, etc.	1,083	439,999	2,100	828,928
Circular saw plates	37	39,837	54	67,991
Sheets of iron or steel, common, or black and boiler or other plate of iron or steel	64,700	8,993,987	215,179	26,261,302
Sheets and plates and steel, n.s.p.f.	6,823	2,397,182	10,976	4,669,932
Tinplate, terneplate, and taggers' tin	15,151	2,651,937	52,479	8,586,908
Structural iron and steel	553,155	59,775,317	709,295	75,589,902
Rails for railways	14,231	1,172,742	10,560	905,247
Rail braces, bars, fishplates, or splice bars and tie plates	472	67,573	268	29,123
Steel pipes and tubes	[1] 521,270	79,845,253	632,329	92,979,275
Wire:				
Barbed	82,457	11,810,235	66,598	8,762,116
Round wire, n.e.s.	172,026	31,036,899	242,250	44,608,626
Telegraph, telephone, etc., except copper, covered with cotton jute, etc.	[1] 1,441	507,815	782	452,765
Flat wire and iron and steel strips	59,881	14,244,943	86,366	17,337,359
Rope and strand	34,178	10,164,586	39,323	11,958,768
Galvanized fencing wire and wire fencing	59,955	8,340,744	73,042	9,641,734
Iron and steel used in card clothing	[2]	250,364	[2]	243,397
Hoop and band iron and steel, for baling	18,432	2,367,807	24,694	3,174,978
Hoop, band and strips, or scroll iron or steel, n.s.p.f.	10,576	1,957,941	12,909	2,265,682
Nails	252,713	36,930,374	281,800	40,084,942
Steel castings and forgings	10,619	1,936,801	8,384	1,490,612
Total	[1] 3,277,325	418,267,709	4,236,605	514,114,501
Advanced manufactures:				
Bolts, nuts, and rivets	[1] 43,584	13,583,140	67,934	20,096,908
Chains and parts	7,052	4,784,443	9,506	6,102,429
Hardware, builders'	----------	1,709,896	----------	2,961,011
Hinges and hinge blanks	----------	1,594,101	----------	1,875,449
Screws (wholly or chiefly of iron or steel)	----------	[1] 1,656,239	----------	3,137,480
Tools	----------	18,070,497	----------	[3] 20,071,345
Other	----------	694,652	----------	1,550,041
Total	----------	[1] 42,092,968	----------	55,794,663
Grand total	----------	[1] 466,154,857	----------	580,543,118

[1] Revised figure.
[2] Weight not recorded.
[3] Due to changes in classifications, data not strictly comparable with 1961.

Source: Bureau of the Census.

TABLE 16.—U.S. exports of major iron and steel products

Products	1961		1962	
	Short tons	Value	Short tons	Value
Semimanufactures:				
Steel ingots, blooms, billets, slabs, and sheet bars	138,044	$13,981,224	252,667	$20,499,709
Iron and steel bars and rods:				
Carbon-steel bars, hot-rolled, and iron bars	51,712	9,058,636	52,491	9,682,725
Concrete reinforcement bars	15,688	2,121,988	22,398	2,950,860
Other steel bars	[1] 23,916	[1] 11,095,127	27,731	12,037,785
Wire rods	5,378	1,893,402	17,006	3,853,784
Iron and steel plates, sheets, skelp, and strips:				
Plates, including boilerplate, not fabricated	[1] 97,403	[1] 19,603,178	119,856	26,187,475
Skelp iron and steel	42,025	4,264,356	11,528	1,121,853
Iron and steel sheets, galvanized	65,933	13,061,939	124,692	25,046,171
Steel sheets, black, ungalvanized	[1] 492,826	[1] 105,036,071	458,073	102,825,501
Strip, hoop, band, and scroll iron and steel:				
Cold-rolled	[1] 35,298	[1] 16,251,769	33,196	15,784,152
Hot-rolled	[1] 34,919	[1] 8,672,301	31,617	6,779,069
Tinplate and terneplate	401,752	66,811,505	329,852	53,011,244
Tinplate circles, cobbles, strip, and scroll shear butts	23,475	2,491,455	24,633	2,756,006
Total	[1] 1,428,369	[1] 274,342,951	1,505,740	282,536,334
Manufactures—steel mill products:				
Structural iron and steel:				
Water, oil, gas, and other storage tanks (unlined), complete and knockdown material	18,536	7,192,752	20,282	8,502,263
Structural shapes:				
Not fabricated	[1] 214,263	[1] 29,152,709	145,702	20,841,902
Fabricated	[1] 53,948	[1] 22,858,191	58,841	29,516,584
Plates and sheets, fabricated, punched, or shaped	8,374	2,708,165	17,507	6,641,010
Metal lath	1,379	514,187	1,215	479,552
Frames, sashes, and sheet piling	14,423	3,097,900	13,881	2,940,590
Railway-track material:				
Rails for railways	89,307	12,218,490	102,191	12,922,089
Rail joints, splice bars, fishplates, and tieplates	14,084	3,793,503	19,921	4,645,589
Switches, frogs, and crossings	1,175	579,105	3,816	1,158,206
Railroad spikes	1,047	293,371	381	110,574
Railroad bolts, nuts, washers, and nut locks	1,050	476,422	881	445,877
Tubular products:				
Boiler tubes	[1] 12,092	[1] 7,975,036	10,424	7,552,287
Casing and line pipe	[1] 92,159	[1] 30,176,471	86,083	27,581,701
Seamless black and galvanized pipe and tubes, except casing, line and boiler, and other pipes and tubes	25,589	7,931,028	32,066	8,681,474
Welded black pipe	9,510	2,631,292	10,168	3,157,823
Welded galvanized pipe	4,480	1,240,594	5,609	1,305,537
Malleable-iron screwed pipe fittings	1,223	1,277,355	1,192	1,389,825
Cast-iron pressure pipe and fittings	14,414	2,852,644	22,630	4,209,718
Cast-iron soil pipe and fittings	5,457	1,362,743	6,373	1,651,629
Iron and steel pipe, fittings, and tubing, n.e.c.	[1] 69,883	[1] 45,487,128	50,451	41,977,794
Wire and manufactures:				
Barbed wire	969	266,219	12,896	2,685,658
Galvanized wire	8,312	2,366,257	10,108	3,116,705
Iron and steel wire, uncoated	9,814	4,105,670	16,206	5,504,412
Spring wire	1,301	892,997	1,469	986,920
Wire rope and strand	8,322	4,940,903	9,553	5,332,085
Woven-wire screen cloth	1,659	[2] 1,951,917	1,956	[2] 2,031,332
All other	13,692	9,865,044	15,123	9,587,589
Nails and bolts, iron and steel, n.e.c.:				
Wire nails, staples, and spikes	3,469	2,967,169	4,060	3,062,177
Bolts, screws, nuts, rivets, and washers, n.e.c.	12,784	16,842,185	15,025	19,210,961
Tacks	612	411,871	692	455,429
Castings and forgings: Iron and steel, including car wheels, tires, and axles	79,461	23,976,477	64,343	24,534,486
Total	[1] 792,788	[1] 252,405,795	761,045	262,220,078

See footnotes at end of table.

TABLE 16.—U.S. exports of major iron and steel products—Continued

Products	1961		1962	
	Short tons	Value	Short tons	Value
Advanced manufactures:				
Buildings (prefabricated and knockdown)		$6,930,535		$7,606,979
Chains and parts	8,410	9,992,243	7,993	10,069,098
Construction material	8,259	6,179,827	9,264	6,598,605
Hardware and parts		22,152,741		23,563,072
House-heating boilers and radiators		6,650,939		6,666,330
Oil burners and parts		8,709,159		8,856,731
Plumbing fixtures and fittings		3,525,125		2,701,981
Tools		[1] 54,835,512		59,161,606
Utensils and parts (cooking, kitchen, and hospital)		3,338,624		3,774,726
Other		37,532,316		45,572,134
Total		[1] 159,847,021		174,571,262
Grand total		[1] 686,595,767		719,327,674

[1] Revised figure.
[2] Includes wire cloth as follows: 1961, $1,418,345 (8,213,881 square feet); 1962, $1,455,917 (7,463,741 square feet).

Source: Bureau of the Census.

WORLD REVIEW [5]

World production of pig iron (including ferroalloys) reached a new high with a 2-percent increase. The largest increase, 5.1 million tons (9 percent), was in the U.S.S.R. World steel production was also at a new high with an increase of 2 percent over 1961. Again the U.S.S.R. showed the greatest gain—6.3 million tons (8 percent). The United States produced 23 percent of the total pig iron and 25 percent of the total steel, the same as in 1960 and 1961.

[5] Values in this section are U.S. dollars based on the average rate of exchange by the Federal Reserve Board unless otherwise specified.

TABLE 17.—World production of pig iron including ferroalloys) by countries[1 2]

(Thousand short tons)

Country[1]	1953–57 (average)	1958	1959	1960	1961	1962
North America:						
Canada	3,326	3,172	4,318	4,416	5,043	5,427
Mexico	370	547	617	733	939	937
United States	74,961	58,867	62,135	68,620	66,717	67,636
Total	78,657	62,586	67,070	73,769	72,699	74,000
South America:						
Argentina	39	32	39	198	440	440
Brazil	1,219	1,550	1,750	1,965	2,045	[3] 1,650
Chile	353	336	320	293	314	428
Colombia	[4] 123	164	138	194	209	220
Venezuela						136
Total	1,734	2,082	2,247	2,650	3,008	2,874
Europe:						
Austria	1,737	2,004	2,025	2,460	2,493	2,335
Belgium	5,638	6,084	6,575	7,223	7,104	7,439
Bulgaria	19	100	195	212	227	243
Czechoslovakia	3,396	4,160	4,679	5,176	5,480	5,730
Denmark	54	49	64	76	71	74
Finland	110	111	119	116	163	377
France	11,568	13,400	13,951	15,921	16,367	14,990
Germany:						
East	1,576	1,957	2,092	2,199	2,237	2,287
West (including Saar)	19,960	21,784	23,814	28,372	28,033	26,732
Hungary	899	1,210	1,235	1,390	1,455	1,548
Italy	1,910	2,389	2,416	3,113	3,528	4,053
Luxembourg	3,371	3,621	3,795	4,173	4,226	3,965
Netherlands	714	1,011	1,259	1,485	1,606	1,732
Norway	419	575	686	794	837	801
Poland	3,379	4,259	4,822	5,030	5,258	5,860
Portugal		19	40	45	134	244
Rumania	599	812	933	1,118	1,211	1,665
Spain	1,030	1,479	1,889	2,124	2,340	2,362
Sweden	1,380	1,559	1,655	1,793	2,091	2,000
Switzerland	47	[3] 40	[3] 50	[3] 60	[3] 60	[3] 60
U.S.S.R.[5]	36,040	43,650	47,370	51,540	56,100	61,200
United Kingdom	14,107	14,532	14,092	17,655	16,517	15,490
Yugoslavia	565	860	995	1,123	1,163	1,216
Total[5]	108,518	125,665	134,751	153,198	158,701	162,403
Asia:						
China	4,200	[6] 10,470	[6] 22,600	30,300	[3] 22,000	[3] 19,800
India	2,129	2,352	3,427	4,621	5,170	6,516
Japan	6,224	8,510	10,908	13,604	18,059	20,325
Korea, North	125	350	765	940	1,025	1,340
Taiwan (Formosa)	14	19	36	26	67	69
Thailand	3	6	8	7	6	6
Turkey	233	254	260	272	207	166
Total[5]	12,928	21,961	38,004	49,770	46,534	48,222
Africa:						
Rhodesia and Nyasaland, Federation of: Southern Rhodesia	60	94	79	77	77	77
South Africa, Republic of	1,434	1,744	1,992	2,204	2,566	2,663
United Arab Republic (Egypt)	8	[3] 45	130	163	[3] 110	[3] 110
Total	1,502	1,883	2,201	2,444	2,753	2,850
Oceania: Australia	2,190	2,553	2,806	3,228	3,538	3,844
World total (estimate)	205,530	216,750	247,100	285,100	287,350	294,200

[1] Pig iron is also produced in Republic of the Congo, but quantity produced is believed insufficient to affect estimate of world total.

[2] This table incorporates some revisions. Data do not add to totals shown because of rounding where estimated figures are included in the detail.

[3] Estimate.

[4] Average annual production 1954–57.

[5] U.S.S.R. in Asia included with U.S.S.R. in Europe.

[6] Based on figures from Chinese sources. 1958 does not include approximately 4 million tons substandard grade iron produced at small plants. 1959 production probably includes pig iron obtained from reworking the low-grade product of 1958 and an unreported quantity (probably relatively small) of substandard iron from small plants, most of which were shut down early in the year.

[7] Average annual production 1955–57.

Compiled by Pearl J. Thompson, Division of Foreign Activities.

TABLE 18.—World production of steel ingots and castings by countries [1]

(Thousand short tons)

Country	1953–57 (average)	1958	1959	1960	1961	1962
North America:						
Canada	4,443	4,359	5,901	5,790	6,466	7,173
Mexico	841	1,144	1,442	1,713	1,846	1,855
United States [2]	108,978	85,255	93,446	99,282	98,014	98,328
Total	114,262	90,758	100,789	106,785	106,326	107,356
South America:						
Argentina	274	269	236	305	486	550
Brazil	1,427	1,581	1,910	2,186	2,382	[3] 2,390
Chile	374	384	457	465	400	546
Colombia	62	133	120	173	194	151
Peru	----------	22	56	66	83	83
Venezuela	----------	----------	----------	----------	6	165
Total	2,137	2,389	2,779	3,195	3,551	3,885
Europe:						
Austria	2,060	2,638	2,769	3,487	3,418	3,274
Belgium	6,161	6,626	7,096	7,923	7,728	8,114
Bulgaria	[4] 98	233	254	279	375	465
Czechoslovakia	5,106	6,074	6,764	7,460	7,764	8,300
Denmark	255	280	322	320	326	405
Finland	198	209	260	285	310	365
France	13,307	15,947	16,617	18,907	19,401	19,004
Germany:						
East	2,786	3,354	3,535	3,678	3,796	3,994
West (including Saar)	25,873	28,930	32,446	37,589	36,881	35,895
Greece	69	125	99	[3] 140	[3] 150	[3] 170
Hungary	1,644	1,793	1,939	2,078	2,263	2,572
Ireland [5]	30	31	44	44	50	50
Italy	5,687	6,913	7,454	9,071	10,057	10,459
Luxembourg	3,452	3,725	4,038	4,502	4,534	4,422
Netherlands	1,106	1,585	1,841	2,141	2,173	2,301
Norway	230	409	470	540	550	539
Poland	4,915	6,242	6,790	7,585	7,974	8,470
Rumania	828	1,030	1,564	1,991	2,345	2,702
Spain	1,335	1,734	1,995	2,157	2,456	2,542
Sweden	2,338	2,653	3,155	3,547	3,921	3,979
Switzerland [5]	194	270	275	300	327	337
U.S.S.R. [6]	49,540	60,539	66,107	71,973	77,791	84,100
United Kingdom	22,014	21,914	22,609	27,222	24,737	22,950
Yugoslavia	853	1,233	1,432	1,590	1,689	1,758
Total [6]	150,079	174,487	189,875	214,809	221,016	227,167
Asia:						
China	3,600	8,820	14,720	20,340	[3] 15,000	[3] 13,000
India	1,871	2,030	2,726	3,623	4,488	5,557
Israel	----------	[7] 29	26	45	68	88
Japan	10,691	13,358	18,330	24,403	31,160	30,364
Korea:						
North [3]	140	400	500	710	850	1,150
Republic of	9	22	42	55	52	79
Taiwan	61	118	175	220	218	201
Thailand	3	6	7	8	9	8
Turkey	198	176	236	330	312	322
Total [6]	16,573	24,959	36,762	49,734	52,157	50,769
Africa:						
Rhodesia and Nyasaland, Federation of: Southern Rhodesia	52	79	51	88	88	88
South Africa, Republic of	1,674	2,019	2,090	2,328	2,738	3,251
United Arab Republic (Egypt) [3]	85	110	110	150	165	165
Total	1,811	2,208	2,251	2,566	2,991	3,504
Oceania: Australia	2,690	3,509	3,803	4,129	4,338	4,663
World total (estimate)	287,550	298,300	336,250	381,200	390,400	397,350

[1] This table incorporates some revisions. Data do not add exactly to totals shown because of rounding where estimated figures are included in the detail.

[2] Data from American Iron and Steel Institute. Excludes production of castings by companies that do not produce steel ingots.

[3] Estimate.

[4] Average annual production 1953–57.

[5] Including secondary.

[6] U.S.S.R. in Asia included with U.S.S.R. in Europe.

[7] Includes 1957 production when plant came into operation.

Compiled by Pearl J. Thompson, Division of Foreign Activities.

NORTH AMERICA

Canada.—Production of pig iron and steel set records in 1962. Pig iron production of 5.4 million short tons was 8 percent higher than the previous record of 5.0 million tons set in 1961. Production of steel ingots and castings was a record 7.2 million tons, 11 percent higher than the previous record 6.5 million tons produced in 1961. Open-hearth furnaces and oxygen converters accounted for 89 percent of the total steel production, and electric furnaces, 11 percent. Total production of carbon steel hot-rolled products was 5.5 million tons, compared with 4.9 million tons in 1961. Imports of iron and steel products were 803,339 tons, and exports were 1,291,229 tons. Pig iron constituted 459,443 tons of the exports. Consumption of 1,203 pounds of coke per ton of pig iron produced was a substantial drop from the 1,418 pounds per ton reported for 1961.[6]

The planned $35 million expansion of Algoma Steel Corp., Ltd., Sault Ste. Marie, Ontario, included a new wide-strip mill, soaking pits, furnaces, and increased oxygen steelmaking capacity.[7]

Atlas Steel, Ltd., was reported to be spending $40 million for the construction of a new stainless steel plant at Tracey, Quebec. The mill was to be completed in 1963 to produce stainless sheet up to 48 inches wide. An unusual feature of the plants was the planned use of 50 to 65 percent hot metal in the charge.[8]

Consolidated Mining & Smelting Co. of Canada, Ltd. (Cominco), announced plans to spend $4 million to triple its pig iron production to 110,000 tons per year. Cominco's main pig iron markets were Western Canada and the Western United States.[9]

Mexico.—The International Finance Corp., and the Mexican financing institution, Credito Bursatil, formed a syndicate to underwrite a $4 million issue of capital shares of Compania Fundidora de Fierro y Acero de Monterrey, S.A., the largest private steel company in Mexico. The underwriting was to assist the company in completing its program of expansion from 200,000 to 500,000 tons annually.[10]

A new steel plant, designed by Friedrich Krupp, was to be constructed on the lower Balsas River. Production from the mill, scheduled to go into operation in 1965, was expected to be 250,000 tons per year. The iron ore deposits at Las Truchas, Michoacan, to be utilized by the plant, were estimated to be sufficient for 100 years of operation.[11]

SOUTH AMERICA

Argentina.—On November 30, 1962, Siderurgica Campana S.A. officially inaugurated its new electric-furnace steel mill in Campana, Buenos Aires Province. Construction of the mill, having an annual capacity of 165,000 tons of steel, was started in 1961. One furnace went into operation a month before the official ceremony, which was postponed until both furnaces were operating. The plant began opera-

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[6] Dominion Bureau of Statistics. Primary Iron and Steel. V. 18, No. 1, January 1963, 27 pp.; No. 3, March 1963, 27 pp.
[7] Iron Age. V. 189, No. 3, Jan. 18, 1962, p. 13.
[8] Iron Age. V. 189, No. 2, Jan. 11, 1962, p. 42.
[9] Western Mines and Oil Review (Vancouver, Canada). V. 35, No. 5, May 1962, pp. 50–51.
[10] Steel & Coal (London). V. 185, No. 4904, July 13, 1962, p. 78.
[11] Skillings' Mining Review. V. 51, No. 48, Dec. 1, 1962, p. 15.

tions using purchased power, but was expected to complete its own 44,500-kilovolt-ampere power installation early in 1963. Plans were made for expansion to a capacity of 330,000 tons per year.[12]

Four Japanese steel firms signed an agreement on February 1, 1962, with the Misiones Provincial Government for the construction of a charcoal blast furnace at Posades in Northeastern Argentina.[13]

The Argentine Government certified the plans of Industrias Argentinas de Acera for expansion of plant facilities in Rosario and Villa Constitucion to an annual capacity of 530,000 tons, triple the former capacity. The estimated cost of the expansion was $90 million, and it was scheduled for completion in mid-1964.[14]

Brazil.—A contract for the construction of a steel plant in the State of Guanabara, costing $250 million, was signed by representatives of a European financial group and by the president of the Cia. Siderurgica da Guanabara. The proposed plant was expected to have an initial annual capacity of 500,000 tons of steel with provision for eventual expansion to 2 million tons. The European financial group consisted of the German firm Krupp, the Belgian firm Syndicat Belge d'Enterprises a l'Etranger, and the French firm Cie. des Ateliers et Forges de France. Approval by the Brazilian Government was necessary before construction could be started.[15]

Companhia Siderurgica da Amazonia was reported to be planning the construction of a steel mill with an estimated annual capacity of 100,000 tons in Manaus, State of Amazonas. Krupp was to supply the equipment and technicians for the new installation in exchange for iron ore from the company's mines.[16]

The steel plant of the Cia. Siderurgica Paulista at Piassaquera was reported ready to start production at an annual rate of 800,000 tons of steel ingots before the end of 1962.[17]

The National Steelworks (Volta Redonda) announced an expansion from 1.1 million tons to 1.5 million tons of ingots annually. Future expansion plans envisaged doubling the output. Acos Anhanguera, a new steel mill for the production of steel for springs, screws, automobile parts, and ball bearings, was organized. Initial annual capacity of 70,000 tons was planned.[18]

Companhia Ferro Brasileiro, a concern that manufactured iron pipe, inaugurated a new 180-ton-per-day blast furnace on August 2.[19]

The first blast furnace of the new Independente Camara steel mill of Usinas Siderurgicas de Minas Gerais S. A. (USIMINAS) was inaugurated on October 26, and the first pig iron was poured October 27. The plant, located at Ipatinga, Minas Gerais (about 100 miles east of Belo Horizonte), cost about $250 million and was an integrated operation with an annual production capacity of 500,000 tons. Future plans called for expansion to 2 million tons annually. About 40 per-

[12] U.S. Embassy, Buenos Aires, Argentina. State Department Airgram A–837, Dec. 7, 1962.
[13] Bureau of Mines. Mineral Trade Notes. V. 54, No. 5, May 1962, p. 22.
[14] Bureau of Mines. Mineral Trade Notes. V. 55, No. 6, December 1962, p. 16.
[15] Steel & Coal (London). V. 184, No. 4883, Feb. 16, 1962, p. 326.
[16] Foreign Trade (Ottawa, Canada). V. 117, No. 10, May 19, 1962, p. 32.
[17] Mining Journal (London). V. 259, No. 6623, July 27, 1962, p. 89.
[18] Mining Journal (London). V. 259, No. 6624, Aug. 3, 1962, p. 110.
[19] U.S. Consulate, Belo Horizonte, Brazil. State Department Airgram A–9, Aug. 14, 1962.

cent of the shares of USIMINAS were owned by a group of Japanese steel companies headed by Yawata Iron and Steel Co., Ltd.[20]

The Brazilian Government authorized the construction of a small steel mill in the southern State of Santa Catarina. The mill, in which the Government was to have a 51-percent interest, was to be called Siderurgica de Santa Catarina S. A. and was expected to have an initial capital of $3 million.[21]

Chile.—Development plans for the next 3 years at the Huachipato plant of Compañía de Acero del Pacifico called for an increase in blast-furnace capacity from the present 1,000–1,100 tons per day to 1,300–1,600 tons per day by using higher iron content concentrates and by injecting gas and fuel oil into the furnace. The capacity of two open-hearth furnaces was to be increased from 100 to 200 tons, and oxygen lancing was to be used in all open hearths. The changes, which were estimated to cost $50 million, were expected to raise the plant capacity to 600,000 ingot tons per year.[22]

Colombia.—As a result of a study of long-range demand for steel products, in Colombia a plan for increasing the annual capacity of Acerias Paz del Rio from 120,000 tons to 550,000 tons per year was submitted to the International Bank for Reconstruction and Development. Financial assistance totaling $50 million was requested to finance the expansion.[23]

Peru.—The West German consortium Ferrostaal agreed to finance the expansion of the Government-owned steel plant at Chimbote from 60,000 to 350,000 ingot tons per year. The expansion was estimated to cost about $130 million.[24]

It was reported that a four-strand continuous-casting machine would be installed at the Chimbote plant by a German firm.[25]

Venezuela.—The new Orinoco steel plant poured its first metal on July 9. Work on the fully integrated steel plant began in 1956, and when completed, it was expected to cost about $312 million. When full production was achieved, the plant was expected to produce annually 770,000 tons of steel ingots and 550,000 tons of pig iron. The planned annual output of steel products from the completed plant was 600,000 tons, which included 325,000 tons of seamless pipe, 94,960 tons of rods, 77,000 tons of structural steel, and 67,800 tons of rails.[26]

EUROPE

The European Coal and Steel Community (ECSC).—Crude steel production decreased 0.7 percent from 1961 to a total of 80.1 million short tons, 0.6 million tons lower than the 80.7 million tons produced during 1961. Production increased by 5 percent in Belgium and the Netherlands and by 4 percent in Italy. It decreased by 3 percent in West Germany and Luxembourg and by 2 percent in France. Production of steel by oxygen processes amounted to 4.8 percent of the total, compared with 3.2 percent in 1961.

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[20] U.S. Embassy, Rio de Janeiro, Brazil. State Department Airgram A–558, Nov. 16, 1962.
[21] Foreign Trade (Ottawa, Canada). V. 118, No. 12, Dec. 15, 1962, p. 33.
[22] Bureau of Mines. Mineral Trade Notes. V. 55, No. 2, August 1962, p. 41.
[23] U.S. Embassy, Bogota, Colombia. State Department Airgram A–331, Nov. 30, 1962.
[24] Mining Journal (London). V. 258, No. 6619, June 29, 1962, p. 675.
[25] Steel. V. 150, No. 7, Feb. 12, 1962, p. 86.
[26] Foreign Trade (Ottawa, Canada). V. 118, No. 5, Sept. 8, 1962, pp. 15–16.

Production of pig iron was an estimated 59.2 million tons, compared with 60.2 million tons in 1961. Consumption of pig iron per ton of steel was 1,378 pounds, down slightly from the 1961 figure of 1,384 pounds. A total of 32.3 million tons of scrap was used in steel production, for an average of 830 pounds per ton, up slightly from the corresponding figures of 32.0 million tons and 816 pounds per ton for 1961.

The increased use of agglomerates in the blast furnace, 1,726 pounds per ton of iron produced, compared with 1,426 pounds per ton in 1961, caused a decrease in coke usage. Coke consumption in ECSC blast furnaces amounted to 52.1 million tons, down from 55.4 million tons in 1961. The corresponding coke rates were 1,620 pounds per ton of iron produced, contrasted with 1,714 pounds per ton in 1961. The use of scrap in blast furnaces decreased slightly from that of 1961, totaling 24.3 million tons, or 81 pounds per ton of iron produced.[27]

United Kingdom.—The first steel was produced in July by one of the L–D (Linz-Donawitz) converters of the new $336 million Spencer Steelworks of Richard Thomas and Baldwins, Ltd. The plant, when fully completed, was expected to have a capacity of over 1.25 million tons per year.[28]

Stewarts and Lloyds, Ltd., planned to replace its Bessemer converter capacity with three LD/AC converters. The LD/AC vessels were to increase the capacity by an unspecified amount over the 800,000-ton-per-year capacity of the Bessemer converters. The new converters, which were estimated to cost $11 million, were expected to be in production by late 1964 or early 1965.[29]

The Panteg works of Richard Thomas and Baldwins began operation of a single-strand continuous-casting machine, designed primarily for the production of stainless steel slabs. Both killed carbon steel and stainless steel slabs, 4⅝ inches by 34 or 38 inches, were initially produced at a speed of 48 inches per minute.[30]

The planned change from open hearth to electric furnaces at the Steel, Peech and Tozer branch of the United Steel Cos., Ltd., was partially completed. Three of the 14 open-hearth furnaces in the Templebrough melting shop were demolished, and 2 electric furnaces were installed. One electric furnace went into operation late in 1962. Upon completion of the changeover in 1965 at an estimated total cost of $31 million, the Steel, Peech and Tozer plant would be the largest electric steelmaking plant in the world, with an annual capacity of 1.35 million tons.[31]

A new 750-ton-per-day blast furnace was blown in at the Dagenham works of Ford Motor Co., Ltd. The new furnace, which cost approximately $3 million, had a hearth diameter of 20 feet and a height of 220 feet. It replaced Ford's original 28-year-old, 500-ton-per-day furnace, which was shut down early in November 1961.[32]

Yugoslavia.—A total of 1,448,500 tons of steel was produced in the first 11 months of 1962. This was an increase of 5 percent over the

[27] European Coal and Steel Community. Eleventh General Report on the Activities of the Community. Jan. 31, 1963. pp. 78–95.
[28] Steel & Coal (London). V. 185, No. 4906, July 27, 1962, p. 157.
[29] Metal Industry (London). V. 101, No. 20, Nov. 15, 1962, p. 295.
[30] Steel & Coal (London). V. 185, No. 4924, Nov. 30, 1962, p. 1043.
[31] Metallurgia (Manchester, England). V. 66, No. 397, November 1962, pp. 215–220.
[32] Metal Industry (London). V. 101, No. 25, Dec. 20, 1962, p. 484.

same period in 1961 and 99 percent of the production planned for the period. Production goals were not attained owing to a lag in orders during the first half of 1962.[33]

The largest producer of special steels, Jesenice Iron and Steel Works, ordered $4.2 million worth of steel mill control equipment and other electrical apparatus from the United States. The equipment included the first card-programmed control system for a reversing hot-strip mill exported from the United States.[34]

A supply contract for approximately $78 million worth of steelmaking and rolling-mill equipment was concluded between two British companies and a new Yugoslavian steel plant, Rudnici i Zelezara. The contract covered the supply of equipment for a new integrated steelworks at Skopje, which was to produce steel plate and strip at an annual rate of 600,000 tons. Total cost of the plant was estimated at $224 million, and construction was expected to require 5 years.[35]

ASIA

China.—During the first 6 months of 1962, production of high-quality steel was more than 50 percent above the total for the entire year 1961. Tool steel production during the first half of 1962 was 40 percent higher than for all of 1961.[36]

Japan.—Steel production declined slightly in 1962. Although pig iron production increased rather sharply (up nearly 13 percent from 1961), total steel production was down to only 98 percent of 1961. Pig iron production increases were attributed to the increasing proportion of oxygen converter steel to total steel and to the starting up of three new blast furnaces, two of them of over 2,000-tons-per-day capacity. The drop in steel production was the result of a temporary shutdown of a number of open-hearth furnaces caused by decreasing demand for ingots and increasing production by oxygen converters.

Production of ingots by oxygen converters was 31 percent of the total, compared with 19 percent in 1961, while open-hearth ingots dropped to 49 percent from 60 percent in 1961. The large increase in production of oxygen-converter steel was attributed mainly to production from the two new 150-ton-capacity converters of Yawata Steel and the two new 130-ton-capacity converters of Kawasaki Steel Corp.

Total production of hot-rolled ordinary steel products was up 2 percent over 1961. Major increases were noted in the production of wire rod (up 21 percent) and electric- and arc-welded pipe (up 21 percent). These large increases were caused mainly by greatly increased exports of these items to the United States.[37]

Yawata Steel was licensed to use the R–N direct-reduction process to treat Japanese iron-bearing sand. Yawata planned to build two plants to produce iron briquettes for use in steel furnaces and to produce sponge iron for use in making electric-furnace pig iron. The

[33] Weekly Economic Report on Western Europe. No. 440, p. 11.
[34] Steel & Coal (London). V. 185, No. 4910, Aug. 24, 1962. p. 366.
[35] Metallurgia (Manchester, England). V. 66, No. 398, December 1962, p. 287.
[36] Steel & Coal (London). V. 185. No. 4923, Nov. 23, 1962, p. 991.
[37] Far East Iron and Steel Trade Reports. Japan's Iron and Steel Output for 1962. No. 57, February 1963, pp. 8–9.

plants were expected to have a combined annual capacity of over 200,000 tons of iron to be produced from underwater sand deposits in Ariake Bay, Kyushu.[38]

Yawata installed gas recovery equipment on its two 130-ton capacity L–D converters at its Tobata No. 2 plant. Carbon monoxide produced during the blow was kept in the unburned state by an airtight recovery hood over the converter mouth and was stored in a gasholder. The calorific value of the recovered gas was about 225 to 280 Btu per cubic foot. It was claimed that the cost of installing equipment of this type was only about 40 percent of the cost of the conventional waste-heat boiler system normally used to recover heat from converter waste gas. An additional advantage was that the total volume of gas from the converters was reduced to about one-fourth of the normal amount because it was not mixed with air, thus allowing the use of a much smaller dust collection system. In a typical test run, about 1,940 cubic feet of gas with a calorific value of about 250 Btu per cubic foot was recovered per ingot ton of steel produced.[39]

Korea, Republic of.—On November 30, the Korean Government signed an agreement with Blaw-Knox Associates for the construction of a $150 million integrated steel plant. The plant, to be finished in mid-1966, was to have an annual capacity of 300,000 tons.[40]

TECHNOLOGY

Injection of fuel continued to be one of the major areas of attention in the continuing drive to increase blast-furnace efficiency. At Sparrows Point, Md., Bethlehem Steel Co. began injecting natural gas into 4 of its 10 blast furnaces. Up to 20 million cubic feet of natural gas per day at a pressure of 60 to 90 pounds per square inch gage was required for the operation. Savings in coke of up to 390 tons per day, as well as increased iron production, were predicted for the installation. Natural gas was also used to enrich the blast-furnace gas used for stove heating with the object of raising the blast temperature to 1,800° F from 1,300° to 1,500° F to further increase efficiency.[41]

Plans were announced to install a coal-injection system on a blast furnace at Weirton Steel Co., Weirton, W. Va. The crushed raw coal was to be injected through the tuyères in the same manner as that used for natural gas or oil. Coal was considered to be more economical than other fuels for this use in many areas of the country, and it could be used as a greater proportion of the total fuel.[42]

Armco Steel Corp. was also reported to be planning the use of coal injection on its largest furnace at Ashland, Ky. The system to be used, which included a pulverizer to grind and dry the coal, was expected to have a capacity of 600 tons per day. The use of coal to replace part of the coke in the burden was expected to result in a decrease of at least $1 per ton in the cost of making pig iron. The installation was expected to be completed early in 1964.[43]

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[38] American Metal Market. V. 69, No. 201, Oct. 18, 1962, p. 22.
[39] Yukawa, M., and K. Okaniwa Yawata Installs Gas Recovery Equipment on Oxygen Converter. Iron and Steel Eng., v. 39, No. 12, December 1962, pp. 141–147.
[40] Steel. V. 151, No. 25. Dec. 17, 1962, p. 33.
[41] Blast Furnace and Steel Plant. V. 50, No. 11, November 1962, pp. 1083–1085.
[42] Iron and Steel Engineer. V. 39, No. 7, July 1962, p. 167.
[43] American Metal Market. V. 69, No. 195, Oct. 9, 1962, pp. 1–2.

A coal injection system was under trial by the National Coal Board at a blast furnace in The Stanton Iron Works Co., Ltd., in England. It was possible to replace part of the coke charge by an equal weight of coal. It was believed that a replacement of up to 30 percent of the normal coke charge was possible on this basis without any sacrifice in iron quality.[44]

The Fuji Iron and Steel Co., Ltd., of Japan started using fuel-oil injection on six of its nine blast furnaces in January. Both pressure and air atomization systems were installed. Oil injection rates of up to 164 pounds per net ton of hot metal were used. The coke-to-oil ratio was between 1.2 and 1.7 within the oil injection range of 100 to 160 pounds per net ton of hot metal. Although the oil injected had a higher sulfur content than the coke used, sulfur content of the metal was kept down by increasing the slag basicity.[45]

The Colorado Fuel and Iron Corp. reported on a series of tests conducted on its F furnace at Pueblo, Colo. The injection of various fuels, with and without oxygen enrichment of the blast, was involved. The effect of increasing oxygen was similar to the effect of increasing blast temperature and permitted the use of more injected fuel with greater utilization efficiency. Also, with continuous oxygen enrichment plus fuel injection (up to 210 pounds of fuel per ton of hot metal at a corrected coke replacement ratio of 1.60), an increase of 1 percent oxygen content in the blast, in the range of 21 to 29 percent, at a constant blast temperature, increased the iron production rate about 5.8 percent. The effects of oxygen enrichment and increasing blast temperature were additive, so that the use of a blast oxygen content of 27 percent plus an increase of 138° F in blast temperature resulted in an increase in production rate of 44 percent. Intermittent oxygen injection resulted in slightly higher production-rate increases. Extra iron produced per ton of oxygen consumed was 1.62 tons during continuous enrichment and 1.71 tons during intermittent enrichment.[46]

A group of 22 major iron and steel producers in the United States and Canada formed Blast Furnace Research, Inc. The organization was intended to represent the producers in a 2-year cooperative research program with the Bureau of Mines, U.S. Department of the Interior, to increase productivity in blast-furnace operation and to improve the quality of pig iron produced in blast furnaces. The work was to be conducted on the Bureau of Mines experimental blast furnace at Bruceton, Pa. The initial studies were aimed at determining the most effective methods of injecting such fuels as natural gas, oil, coal, and oil-coal and oil-water slurries. Members of Blast Furnace Research, Inc., are Alan Wood Steel Co., Algoma Steel Corp., Ltd., Armco Steel Corp., Bethlehem Steel Co., Dominion Foundries and Steel, Ltd., Dominion Steel and Coal Corp., Ltd., Ford Motor Co., Granite City Steel Co., Inland Steel Co., Interlake Iron Corp., Jones & Laughlin Steel Corp., Kaiser Steel Co., Lone Star Steel Co.,

[44] Steel & Coal (London). Solid Fuel Injection May Improve Furnace Efficiency. V. 185, No. 4925, Dec. 7, 1962, pp. 1092–1095.

[45] Blast Furnace and Steel Plant. Fuel Oil Injection Into Blast Furnaces of Fuji Iron and Steel Co., Ltd. V. 51, No. 1, January 1963, pp. 25–31.

[46] The Colorado Fuel and Iron Corp. (Pueblo, Colo.) and Newark Laboratories, Linde Company, Division of Union Carbide Corp. (Newark, N.J.). Continuous and Intermittent Blast Furnace Oxygen Enrichment With Various Injected Fuels at the Colorado Fuel and Iron Corporation's Pueblo Plant. Pres. at meeting of Association of Iron and Steel Engineers, Colorado Springs, Colo., June 5, 1962, 23 pp.

National Steel Corp., Pittsburgh Steel Co., Republic Steel Corp., The Shenango Furnace Co., The Steel Co. of Canada, Ltd., United States Steel Corp., Wheeling Steel Corp., Wisconsin Steel Division, International Harvester Co., and The Youngstown Sheet and Tube Co.[47]

Huron Valley Steel Corp. developed a small water-cooled furnace and superior hot-blast system that was claimed to reduce blast-furnace installation costs by 75 to 80 percent. The furnace operated at a blast temperature of 1,875° F and converted scrap to pig iron in 15 minutes. Output of over 2,000 tons per week was sold at approximately $10 per ton less than other domestic pig iron.[48]

Improvements in blast-furnace technology resulted in setting new production records. In March, a blast furnace at the Middletown, Ohio, plant of Armco Steel Corp. set a U.S. record of 89,551 tons of iron produced in 1 month. This record was soon broken by the B furnace at the Bethlehem, Pa., plant of the Bethlehem Steel Co., which produced 92,124 tons of iron in May. The new mark was credited to the use of a higher quality burden. Most of the ore fed to the furnaces was in pellets having an iron content of 65 percent and a silica content of 4 percent. A special low-sulfur (0.73 percent), low-ash (7.8 percent) coke was used. Holding fines to a minimum in the burden allowed a higher-than-normal wind rate. Coke consumption was only 1,172 pounds per ton of iron produced.[49]

The No. 3 blast furnace at the Clay Lane Ironworks of Dorman Long, Ltd., set a new British record for iron production during a single campaign. The furnace produced a total of 2,482,000 tons during 6 years of continuous operation.[50]

In steelmaking, major interest was in the oxygen converter; however, improvements in open-hearth technology continued to be introduced in an effort to make the open-hearth furnace more economically competitive with the oxygen converter. The trend toward the use of oxygen to increase the speed of open-hearth steelmaking continued, and before the end of 1962 it was estimated that about one-third of the Nation's open-hearth furnaces (generally the larger and more modern furnaces) had been converted to use oxygen. It was estimated that these furnaces produced approximately 50 percent of the open-hearth steel made in the United States.[51]

Tests on oxygen for selective flame enrichment, carried out in a French steel plant, showed that this technique could reduce overall charging time by 23 percent and tap-to-tap time by 32 percent, resulting in a production increase of 37 percent, while reducing fuel consumption by 20 percent. The method, developed by the International Flame Research Foundation at Ijmuiden, the Netherlands, employed an oxygen lance located about 2 feet below the burner and extending about 4 feet farther into the furnace than the burner. By enriching only the lower part of the flame in this manner, a high-oxygen atmosphere was maintained over the metal bath, thus decreasing the time required for refining reactions; at the same time, the cooler upper por-

[47] Iron and Steel Engineer. V. 39, No. 9, September 1962, p. 244.
U.S. Department of the Interior News Release. Cooperative Blast Furnace Studies with Steel Industry Now Underway. P.N. 16425–62, Oct. 15, 1962, 1 p.
[48] American Metal Market. V. 69, No. 53, Mar. 19, 1962, p. 16.
[49] Skillings' Mining Review. V. 51, No. 24, June 16, 1962, p. 6.
[50] Metallurgia (Manchester, England). V. 66, No. 398, December 1962, p. 274.
[51] Steel. V. 151, No. 12, Sept. 17, 1962, p. 100.

tion of the flame protected the roof refractories, thus increasing their useful life. This method generated a smaller volume of iron oxide fume than with conventional roof lancing.[52]

Using oxygen in the open hearth, combined with improved refractories, accelerated steelmaking, reduced costs, and made the open hearth more competitive with the oxygen converter. As an indication of the rapid progress in the improvement of the open hearth, a large Canadian furnace achieved steelmaking rates of slightly over 100 tons per hour.[53] This was still far less than the 300 tons and more per hour achieved on some large oxygen converters, but it was a remarkable achievement when contrasted with the rate of 15 to 20 tons per hour considered normal only 10 years ago.

Another improvement that promised lower operating costs for open-hearth furnaces was the use of cast bottoms. Sharon Steel Corp. installed a cast bottom on one of its furnaces at its Roemer Works, Farrell, Pa., and reported that it was in excellent condition after more than 300 heats. The high-density bottom, prepared from a castable mix with a magnesium oxide content of over 90 percent, was installed in only 18 hours.[54]

Carbon subhearths consisting of carbon blocks 28.5 inches wide and 13.5 inches thick laid on top of a bed of insulating refractory material were installed in three open-hearth furnaces of Republic Steel Corp. Observations made on 1 furnace after 2,351 heats showed that the line of physical separation between the carbon and working hearths was clearly visible, and there was no evidence of wetting or metallic penetration of the subhearth.[55]

Improved methods of repairing roof refractories also gave promise of reducing costs. The Algoma Steel Corp. nearly doubled the roof life of its furnaces by using a gunning technique to repair the basic refractories. Average roof life of the company's 360-ton furnaces rose from 274 heats in 1961 to 502 heats with the new technique, and the average roof life of the 180-ton furnaces rose from 380 heats in 1961 to 777. Although refractory consumption and cost were higher with the gunning technique than with conventional methods, the savings in labor and reduction in downtime resulted in a significant lowering of maintenance cost.[56]

Basic oxygen steelmaking continued its rapid expansion, accounting for about 5.5 percent of the total domestic production of steel during 1962. Two plants went into operation in the United States during the year, raising the existing capacity to approximately 10.8 million tons, and plans were announced for the construction of seven additional plants over the next 2 years which would double this capacity.

Both plants that went into operation during 1962 represented important changes in U.S. steelmaking technology. On September 30, Great Lakes Steel Corp. of Detroit, Mich., began operating the largest oxygen converters ever built. The two 300-ton capacity vessels gave

[52] Madsen, I. E. Developments in the Iron and Steel Industry During 1962. Iron and Steel Eng., v. 40, No. 1, January 1963, pp. 137–200.
[53] Journal of Metals. V. 14, No. 1, January 1962, p. 15.
[54] Steel. Cast Open Hearth Bottom Reduced Steelmaking Cost. V. 150, No. 25, June 18, 1962, p. 104.
[55] Work cited in footnote 51.
[56] American Metal Market. V. 70, No. 65, Apr. 4, 1963, p. 4.

the plant an annual capacity of about 2.3 million tons, making it the world's largest basic oxygen facility.[57]

The other new plant that began operating was the Stora-Kaldo plant of Sharon Steel Corp., Sharon, Pa. This plant, with an initial annual capacity of about 1 million tons, went into operation on October 16, marking the first use of the Stora-Kaldo process in the Western Hemisphere. The Sharon plant was also the first domestic steelmaking plant to use digital-computer control.[58]

A list of the existing and planned basic oxygen steelmaking plants in the United States is shown in table 19.

Oxygen steelmaking facilities were being expanded throughout the rest of the world also. Kaiser Engineers, Oakland, Calif., released the results of a survey on plants using the L–D oxygen steelmaking process. The survey showed that existing free world annual capacity, exclusive of the United States, totaled 24.38 million tons, with an additional 32.89 million tons planned for completion before the end of 1965.[59]

TABLE 19.—Existing and planned basic oxygen steelmaking plants in the United States as of Dec. 31, 1962

Company	Location	Number of furnaces	Capacity of each furnace, tons per heat	Annual plant capacity, tons	
				Existing	Planned
Acme Steel Co	Riverdale, Ill	2	75	450,000	
Armco Steel Corp	Ashland, Ky	2	140		1,400,000
Bethlehem Steel Co	Lackawanna, N.Y	2	200		1,700,000
The Colorado Fuel and Iron Corp.	Pueblo, Colo	2	100	1,000,000	
Ford Motor Co	Dearborn, Mich	2	225		1,800,000
Great Lakes Steel Corp	Detroit, Mich	2	300	2,300,000	
International Harvester Co	Chicago, Ill	2	120		1,200,000
Jones & Laughlin Steel Corp	Aliquippa, Pa	2	80	880,000	
Do	Cleveland, Ohio	2	200	1,850,000	
Kaiser Steel Co	Fontana, Calif	3	110	1,440,000	
McLouth Steel Corp	Trenton, Mich	3	60	1,880,000	
Do	do	2	80		
Do	do	1	110		
Pittsburgh Steel Co	Monessen, Pa	2	150		1,500,000
Sharon Steel Corp	Sharon, Pa	[1] 2	150	1,000,000	
United States Steel Corp	Duquesne, Pa	2	150		1,500,000
Wheeling Steel Corp	Steubenville, Ohio	2	200		1,700,000
Total				10,800,000	10,800,000

[1] Stora-Kaldo type.

One of the drawbacks in replacing open hearths by L–D converters was the increased hot-metal capacity needed to supply the converters. Additional hot metal was necessary because of the inability of the L–D converter to handle more than about 25 percent of scrap. Recent experiments conducted at the United Austrian Iron & Steel Works, Linz, Austria, indicate that this disadvantage may be overcome in the future. By adding coke in the cold charge as a source of heat or by injecting gas or liquid fuel with oxygen in the lance, almost any desired proportion of scrap may be used in the charge.

[57] Iron Age. V. 190, No. 15, Oct. 11, 1962, p. 115.
[58] Scrap Age. V. 19, No. 11, November 1962, p. 49.
[59] Skillings' Mining Review. Growth of the L–D Steelmaking Process. V. 51, No. 28, July 14, 1962, pp. 1, 6–8.

In some experiments a completely solid charge, consisting of alternate layers of scrap and coke, was converted to steel.[60]

There were indications that basic oxygen furnaces, which have been replacing open-hearth furnaces at a rapid rate for carbon steel production, may soon be used in alloy and stainless steel production, thus threatening to replace electric furnaces for some of these uses. According to the AISI, alloy steel production (excluding stainless steel) by the basic oxygen process totaled 50,454 tons in the United States compared with only 6,274 tons in 1961. Although no basic-oxygen production of stainless steel was reported in the United States in 1962, experiments in Germany and Austria indicated that stainless steel production in oxygen converters was feasible. Two different methods were used for stainless steel production. In one method, the alloying additions were premelted in an electric furnace and added to the converter in the final stage of the process or added to the ladle. In the other method, the solid alloying materials, either cold or preheated, were added to the converter and melted by the heat generated during the refining process.[61] In the United States, Allegheny Ludlum Steel Co. was reported to be considering the production of stainless steels in the basic oxygen converter.[62]

The increased use of oxygen converters for steelmaking resulted in a greatly increased demand for lime. A new type of high-capacity shaft kiln, suitable for on-site operation at oxygen steel plants, was announced by Union Carbide Metals Co., New York. It was claimed that the new kiln had a production capacity 500 percent greater than most conventional shaft kilns. It was also claimed that, compared with a conventional rotary kiln, there was a 33-percent reduction in labor costs, a 40-percent reduction in maintenance costs, and a 20-percent reduction in lime production costs.[63]

A research program for determining the efficiency of lime in oxygen steelmaking processes was started at the Southern Research Institute, Birmingham, Ala. In the program, which was sponsored by the National Lime Association, Washington, D.C., hard-burned lime of low chemical reactivity and soft-burned lime of high chemical reactivity (both made from the same type of limestone) were to be compared for effectiveness in removing impurities. The study was to be made in an induction furnace, using oxygen and lime rates comparable to commercial practice. Chemical analyses of the hot metal were to be made at intervals of 5, 10, 15, 20, and 30 minutes from the beginning of the blow.[64]

Improvements in refractories for basic oxygen converters resulted in substantially increased lining life and a lowering of overall steelmaking costs. Jones & Laughlin Steel Corp. reported a lining life of 436 heats in a converter at its Aliquippa, Pa., plant, using a high-purity MgO brick.[65]

[60] Steel. Breakthrough: 95% Scrap in Oxygen Steelmaking. V. 150, No. 25, June 18, 1962, pp. 102, 104.
[61] American Metal Market. V. 69, No. 180, Sept. 18, 1962, p. 5.
[62] Iron Age. V. 190, No. 16, Oct. 18, 1962, pp. 132–133.
[63] American Metal Market. V. 69, No. 147, Aug. 1, 1962. pp. 1, 20
[64] American Metal Market. V. 69, No. 211, Nov. 1, 1962, p. 6.
[65] Journal of Metals. V. 14, No. 1, January 1962, p. 15.

McLouth Steel Corp., using a larger converter, claimed a world tonnage record for basic oxygen furnace linings of 40,027 tons of steel produced in 388 heats.[66]

Interest by U.S. steelmakers in the use of continuous casting continued to grow. McLouth Steel Corp. ordered the first full-scale continuous-casting machine in the United States. A contract was let to Concast Ltd., New York, a subsidiary of Concast Ltd., of Switzerland, for a single-strand machine capable of turning out steel slabs 10 inches thick and 66 inches wide. Both carbon and stainless steel slabs were scheduled to be produced.[67]

National Steel Corp. was reported to have entered into a joint engineering study of the continuous-casting process with Concast Ltd. of Switzerland. The study was to evaluate the economic factors and the physical adaptability of the process to the existing steelmaking and processing facilities of the National Steel Corp. plant.[68]

A number of other firms were reported to be interested in continuous casting. United Engineering & Foundry Co., Loftus Engineering Corp., National Patent Development Corp., and H. K. Ferguson Co. were all reported to have entered into agreements with various foreign firms over continuous-casting patent rights.[69] Kaiser Steel Co. also exhibited interest in continuous casting.[70]

The first plant in the United States for the continuous casting of iron began operating at the Skokie, Ill., plant of the Wells Manufacturing Co. The casting machine used water-cooled graphite molds to produce round bars ranging in diameter from 0.75 inch to 4 inches, and square or rectangular shapes could also be manufactured. Bars of gray, alloy, and ductile iron were produced. Continuous-cast bars were claimed to have fine-grain structure and uniform hardness.[71]

Atlas Steel, Ltd., of Canada ordered a large machine for casting slabs of stainless and alloy steels up to 50 inches wide. The machine was to be equipped with a slab bending and straightening system.[72]

One disadvantage of the continuous-casting method was the rather limited capacity of the available machines. Although this has not been a serious problem for plants with oxygen converters, which produce relatively small heats at short intervals, it is a major problem for plants with large open hearths, which may produce 400 to 600 tons of steel in a single heat. It may also prove to be a problem for plants equipped with large oxygen converters of 200- to 300-ton capacity. Although continuous-casting plants of high capacity were being planned, they required either high towers or deep pits and heavy lifting equipment. An article suggested that a semicontinuous process, similar to the direct-chill casting process widely used by the aluminum industry, could overcome some of the difficulties inherent in the continuous-casting process while retaining its advantages. The

[66] Iron and Steel Engineer. V. 39, No. 9, September 1962, p. 266.
[67] American Metal Market. V. 69, No. 199, Oct. 16, 1962, p. 16.
[68] American Metal Market. V. 69, No. 196, Oct. 10, 1962, pp. 1, 5.
[69] Iron age. V. 190, No. 24, Dec. 13, 1962, pp. 75-76.
[70] Metalworking News. V. 3, No. 116, Dec. 24, 1962, p. 18.
[71] American Metal Market. V. 69, No. 125, June 29, 1962, p. 4.
[72] Iron and Steel Engineer. V. 39, No. 12, December 1962, pp. 212, 214.

semicontinuous process would use water-cooled split ingot molds that could be unloaded by a hydraulic ram from below to cast billets and slabs suitable for rolling into finished shapes. It was claimed that such molds would yield a larger proportion of sound ingots than the conventional practice and that the surfaces would be good enough to minimize or completely eliminate surface treatment before rolling.[73]

[73] Balster, H. W. Semicontinuous Casting of Steel Ingots. Metal Prog., v. 81, No. 3, March 1962, pp. 85–88, 122, 124, 126, 128.