Corrigan, MCKinney Steel Company OH-13
On both sides of Cuyahoga River, 3 mi SE of Public Square
Cuyahoga County
Cleveland
Ohio

Photographs and written data

Historic American Engineering Record
National Architectural and Engineering Record
National Park Service US Department of Interior
Washington DC 20243

Addendum to

CORRIGAN, McKINNEY STEEL COMPANY
(Republic Steel Company)
Cleveland
Cuyahoga County
Ohio

HAER No. OH-13

PHOTOGRAPHS

WRITTEN AND DESCRIPTIVE DATA

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National Park Service
Department of the Interior
Washington, D. C. 20240

HISTORIC AMERICAN ENGINEERING RECORD

CORRIGAN, McKINNEY STEEL COMPANY
(Republic Steel Company)

OH-13

Location: On both the east and west banks of the Cuyahoga River, approximately 3 miles southeast of the Public Square, Cleveland, Ohio (plant office at ~~3100 West 45th Street,~~ 3100 East 45th Street Cleveland).
UTM: 17.444400.4591325
Quad: Cleveland South

Major Dates of Construction: 1909-1912; 1913-1916; 1925-1927

Present Owner: Republic Steel Corporation
Republic Building
Cleveland, Ohio 44115

Present Use: Integrated steel works

Significance: Dalliba, Corrigan & Company (later Corrigan, Ives & Company) was one of the leading ore merchants on the Great Lakes during the late nineteenth century. Unable to sell the full capacity of its Lake Superior mines, the company leased or acquired blast furnaces in Ohio, New York, and Pennsylvania, and in 1909 began the construction of two stacks on the Cuyahoga River in Cleveland that became the nucleus of one of America's important independent steel companies, the Corrigan, McKinney Company. Between 1913 and 1916, Corrigan, McKinney built two additional furnaces and a steel works for the production of blooms, sheet bars, and billets. The problem of industry-wide integration led the company to later add merchant mills for the production of finished steel. In 1935, Corrigan, McKinney was acquired by the Republic Steel Corporation. The plant has been continuously enlarged and is today one of the nation's ten largest steel plants.

Historian: Carol Poh Miller
October 1979

"We had made a survey to discover the most logical place in the United States for big steel plant. Among the factors considered were water transportation for ore, short rail haulage for coal, and a strategic location for economical distribution of products. Finally, after tedious months of engineering work, it became possible for us to stick a pin in the map and say: 'There is the place!' As it happened, the spot designated for our figuring was thirty miles east of Cleveland. Obviously then, as if some Delphic Oracle of economic had spoken, we knew that what we ought to get was the Corrigan, McKinney Steel Company...."

--Tom M. Girdle, past president
Republic Steel Corporation,
in his autobiography, Boot Straps (1943)

Author's Note

This report is not a comprehensive or complete history of the Corrigan, McKinney Steel Company site in Cleveland. The report more modestly outline the history of that firm, and provides general background information to accompany HAER's photographic survey of the site. The author wishes to thank the Republic Steel Corporation for its generous assistance. This firm permitted a close-up look at both old and new technologies at its Cleveland plant. J. Eric Heyworth, chairman of the Mechanical Maintenance Committee, and Deborah A. Kavulich, Public Affairs Representative, conducted the author on a tour of the Cleveland District steel plant. Chuck Bayless, of the plant's engineering department, answered numerous questions about the plant's evolution over time. Mr. Bayless has organized and meticulously labeled Republic's collection of several hundred photographs documentinmg the construction of the original Corrigan, McKinney steel plant; three of these illustrate this report. Dennis Beran, also of the engineering department, located the plant maps reproduced here.

Finally, a number of historical photographs accompanying this report appear through the courtesy of the Cleveland Press, the Plain Dealer, the history department of the Cleveland Public Library, and the Western Reserve Historical Society, all of whom made exceptions to their usual policies in order to assist this research project.

After the first trial shipments of Lake Superior iron ore came into its harbor in 1852, Cleveland dominated the ore trade on the Great Lakes. Boosted by the completion of the Cleveland & Pittsburgh Railroad in 1853, the city became the chief transshipment center for ore heading to the inland iron districts of Pittsburgh and the Ohio Valley. Cleveland capitalists, at the helms of such companies as Cleveland Cliffs, M.A. Hanna, and Pickands, Mathers to own or control 80% of the ore vessels plying the lakes.[1]

The origin of the Corrigan, McKinney Steel Company reaches back to the 1880s, when Captain James Corrigan, a blustery Irishman, began building up a fleet of lake vessels to carry iron ore. Dalliba, Corrigan & Company (later Corrigan, Ives & Company) mined and sold iron ore until 1893, when it went into receivership. Price McKinney, a "precise, methodical bookkeeper," then serving as secretary of the firm, was appointed receiver. Under his direction the company developed into the largest independent seller of Lake Superior iron ore, controlling mines on the Mesabi, Gogebic, Menominee, and Marquette ranges.[2]

Although the firm began as a merchant of iron ore, "after a time most of its customers had acquired mines of their own, so the company leased blast furnaces to use its own ore."[3] By the turn of the century, Corrigan, McKinney operated furnaces in Cleveland (river furnaces), Charlotte, New York (near Rochester), and Scottdale and Josephine, Pennsylvania. In 1908, the company purchased forty acres of land along the west bank of the Cuyahoga River in Cleveland. Construction of the first of two stacks began the following year.[4]

The Cleveland Plain Dealer of 1 August 1908 reported that "the new furnaces each (will) have capacity to produce 200,000 tons of pig iron yearly and will give employment to 800 men. The improvement is one of the most important steps in the Cleveland district in years." Furnaces No. 1 and No. 2 -- each 83 feet high by 20 feet, 3 inches in diameter, of the "vertical elevator type, steam driven and hand filled" -- were blown in on 28 May 1910 and 20 June 1912, respectively. Each had a daily capacity of 350 tons. An extensive ore dock, consisting of three Hulett unloaders with 10-ton capacity clamshell buckets and two Brownhoist ore bridges, also with 10-ton buckets, were built to serve the new plant.[5]

The difficulty of selling merchant pig iron to steelmakers, who increasingly operated their own blast furnaces, prompted Corrigan, McKinney to enter the steel business. Iron Age later reported that "having ownership in large and important Lake Superior ore properties, (the company) decided to erect a steel plant to convert a portion of its ore into semi-finished steel and to make a corresponding increase in its blast furnace output.[6]

Between 1913 and 1916, Corrigan, McKinney erected an extensive plant for the production of steel bars, billets, and slabs. Two additional blast furnaces were built next to the original two. On the east side of the river, the company erected open-hearth furnaces, rolling mills, and a coke plant. The facility was designed and built under the direction of Henry T. Harrison (1872-1958), then chief engineer for the company. Extensive professional photographs taken during these years document the plant's construction, which began on 13 March 1913 and continued through 1914 and 1915. The first steel was poured on 20 January 1916. The rolling mills began operation "a few months later," marking "an important epoch in the steel-making industry of (Cleveland) and northern Ohio."[8]

The general layout of the Corrigan, McKinney steel plant is shown in a 1927 drawing photocopied by HAER. The plant was located in the lowlands of the Cuyahoga River Valley, known as the "Flats," about three miles south of the city's central business district. On the west bank of the river, bounded on the west by the Wheeling & Lake Erie Railroad and on the north by the Baltimore & Ohio Railroad, was the blast furnace plant and the main power station. A private Scherzer rolling lift bridge connected the blast furnaces with the steel and coke plants, located on the east side of the river. The open-hearth furnaces and rolling mills were bounded by Independence Road on the west, Dille Road on the north, and Clark Avenue Bridge (1917) on the south; to the east, the plant was hemmed in by the steep bank of the river valley, at the top of which perched the small wood frame homes of East European immigrants. The coke plant was located on the east bank of the river, south of the Clark Avenue Bridge (not shown on the map). The River Terminal Railway, a subsidiary of Corrigan, McKinney, linked the separate sections of the plant.

Corrigan, McKinney employed a "unique method" of slag disposal according to a report for Iron Trade Review. Slag from the furnaces was hauled in "cinder ladles" to a dump located near the coke-oven plant, where it was poured and allowed to cool. The cold slag was then delivered in cars to a slag crusher, where skip cars hoisted it to the top of a "vertical cone-shaped crusher." A magnet suspended over the mouth of the crusher removed the metallic content of the slag. The broken slag was sent to a revolving conical screen, which distributed the material into cars by sizes varying from 1-1/2 inches to sand.[9]

In the open-hearth department, the molten iron was transferred to a 1000-ton mixer built by the Pennsylvania Engineering Works of New Castle, Pennsylvania, first placed in operation on 17 February 1916. The mixer stored and then blended many batches of molten iron into a homogeneous product. The metal was then tapped into 60-ton ladles and transferred to

one of twelve 75-ton capacity, basic open-hearth furnaces. Nine of the furnaces were fueled by coke-oven gas and tar, while three used producer gas generated in an adjacent building. The materials for charging the furnaces -- limestone, scrap metal, and ore -- were stored in an adjacent yard served by two 10-ton cranes equipped with lifting magnets.

The stripping department, soaking pits, blooming mills, and sheet bar and billet mills were located in a large building east of, and parallel to, the open-hearth department. Ingot molds filled with molten steel travelled on flat cars called "ingot buggies," to the south end of the mill, where they were stripped by a Morgan 10-ton "crane-type stripper." Two Morgan pit cranes lowered the ingots into one of twenty-four soaking pits, each able to accommodate six 20 by 22-inch ingots. In the soaking pits, heated by coke-oven gas, the ingots were brought to a uniform temperature suitable for rolling.

From the soaking pits, buggies transferred the ingots to the two-high, 40-inch reversing blooming mill. ("40 inches" describes the distance from the center of the roll pinions, and roughly corresponds to each roll's diameter.) The 40-inch blooming mill, equipped with hydraulic side guards and "Kennedy" manipulators, rolled blooms from 4x4 inches to 16x16 inches in size, and slabs from 12x3 inches to 24x18 inches. The steel blooms were cut to specified lengths by an 8x36-inch shear. The blooming mill, built by the United Engineering & Foundry Company of Pittsburgh, had a monthly capacity of 42,000 ton.

The 40-inch mill rolls were directly connected by nickle spur gears to a twin tandem, compound condensing, reversing steam engine built by the Mesta Machine Company of Pittsburgh. This 46x76x60-inch engine had a rated capacity of 35,000 h.p. Steam for the engine was generated in six 823 h.p. Babcock & Wilcox boilers fueled by coke-oven gas.

Blooms that required re-rolling to smaller sizes passed to the 21-inch and 18-inch sheet bar and billet mills. The 21-inch mill, a four-stand, two-high continuous train of rolls, was built to roll slabs under 12x3 inches in size and billets under 4x4 inches. Sheet bars from 8 to 12 inches wide and billets from 1-1/2 to 3 inches wide were rolled on the 18-inches, six-stand continuous mill. Both mills, including shears, tables, and hot beds, were built by the Morgan Construction Company of Worcester, Massachusetts. They were driven through a common shaft and spur gears by a 6600-volt, 5750 h.p. electric motor built by the General Electric Company of Schenectady, New York. The 21 and 18-inch mills, like the 40-inch blooming mill, were controlled from a pulpit "convenient for vision of the mills."[10] A 1926 photo, copied by HAER, shows the original nucleus of the Corrigan, McKinney

steel plant. Coke for charging the blast furnaces was made at a coke-oven plant, located south of the rolling mills, consisting of 204 by-product coke ovens arranged in four batteries of 51 ovens each. The coke plant, built by the H. Koppers Company of Pittsburgh, began operation on 9 November 1916. Coal was stored in a yard of 125,000-tons capacity served by a 200-foot bridge built by the Brown Hoisting Machinery Company of Cleveland. The ovens, each 40 feet long, 10 feet high, 19-1/2 inches wide, with a 2-1/2 inch taper, operated on an 18-hour basis. One hundred thousand tons of coal were consumed each month, yielding a corresponding coke production of 70,000 tons. Surplus gas from the plant supplied the open-hearth department, soaking pits, and blooming mill boiler house.

Until 1927, Corrigan, McKinney produced only semi-finished steel, i.e., blooms, sheet bars, and billets. Apparetly the company was hampered by the "very limited market into which to dispose of so large an output of steel."[11]
In order to increase its opportunity for sales, Corrigan, McKinney added two merchant mills[12] -- 10-inch and 12-inch bar mills -- in 1927. The addition of the two mills, and the erection of a five-story office building at the plant in 1925, represented the company's last period of expansion prior to its acquisition by the Republic Steel Corporation in 1935.

Both the 10-inch and 12-inch bar mills, which paralleled each other at the east end of the steel plant, were built in 1925-1926 by the Morgan Construction Company.[13] Billets were delivered from a storage yard spanning the north end of the mills. At the 10-inch mill, a charging conveyor carried the billets to a continuous Morgan "side charged, side-discharge" furnace heated by coke oven gas. Leaving the furnace, the billet passed through four roughing stands of 14-inch rolls, then into four stands of 12-inch rolls. The billet next passed through three intermediate stands, then four finishing stands. From the finishing stands, the piece (now a bar) passed to the 450-foot cooling bed or to the pouring reels or ribbon reels for coiling.

The 12-inch mill was a "cross-country" mill with 14 stands of rolls. The name "cross-cuntry" derives from the method of transferring the bars from one stand to the next; the bar travels through several stands in one direction, then is transferred and rolled back in the opposite direction through several more stands, then transferred again and rolled through several more stands in the original direction.[14] In the 12-inch mill at Corrigan, McKinney, the billet pushed from the Morgan continuous furnace passed through the first four stands, then was carried over a transfer table and conveyed backwards through two stands.

Another transfer table carried it to rollers which gain reversed its direction through stands Nos. 7 and 8. The billet (by this time, a bar) was again reversed and sent through stands Nos. 9, 10, and 11, then reversed and sent through stands 12, 13, and 14. From the last stand, the piece was conveyed to the cooling table.

The 10-inch merchant mill produced rounds from 1/4 to 7/8 inch, squares from 1/4 to 3/4 inch, and nut flats of equivalent cross section. These could be cut in lengths or coiled. The 12-inch mill produced rounds from 7/8-inch to 3-3/4 inches, flats from 2xl/4 to 10xl/2 inches, and squares from 7/8 to 3-1/2 inches.

With the passing of ownership of the Corrigan, McKinney Steel Company to the Republic Steel Corporation in 1935, the former's "amazing record" as an independent unit was brought to a close. The company acquired by Republic, which had begun with a capitalization of a quarter million dollars, now enjoyed a surplus of $49 million. Iron ore properties, coal mines, blast furnaces, and a steel works had been accumulated out of the earnings of half a century.[15]

At the time of the takeover by Republic, Fortune magazine called Corrigan, McKinney's relatively brief corporate history "as tragic and sensational as any in the annals of American business."[16] The company was the creation of two men, Captain Jim Corrigan and Price McKinney, both self-made men who "lived and breathed for the steel business." When "Captain Jim" died in 1908, he left his son, James W. Corrigan, a 40 percent interest in the firm, to be held in trust by Price McKinney, until the boy came of age. When Price McKinney changed the company's name to McKinney Steel Company in 1917, "Young Jim" challenged the move in court and won control of his share of the stock. While Young Jim allegedly socialized with royalty in London, Price McKinney -- an inspired steel master" -- ran the business, building up "one of the most efficient steel plants in the country," according to Fortune.

In May 1925, Young Jim Corrigan announced that he had added 13 percent of the company's stock to his own holdings, giving him a clear majority. Corrigan took over the presidency, changed the firm's name back to Corrigan, McKinney, and set out to learn the steel business. Price McKinney, who had served as president since 1909, was ousted, and later committed suicide in 1926. Less than two years later, Young Jim Corrigan died of heart failure, leaving majority control of the company in the hands of his widow, Laura Corrigan. So matters stood in 1930 when Cyrus Eaton was looking for additions to Republic Steel. Eaton engineered Corrigan, McKinney's purchased by the Cleveland-Cliffs Iron Company, and the firm was acquired by Republic five years later.

The Republic Steel Corporation was formed in 1930, with the old Republic Iron and Steel Company as its nucleus. Various minor units, including Cleveland's Bourne-Fuller Company (formerly the Upson Nut Company), had been added. As organized, Republic was the third largest steel producer in the United States. Most of its mills were located in the interior--in Ohio's Mahoning Valley at Youngstown, Warren, and Niles, and in Canton and Massillon, Ohio. Republic also had iron ore properties in the Lake Superior region and in Alabama, and coal mines in Pennsylvania, West Virginia, and Alabama.[18] The location of its producing units put Republic at a distinct disadvantage; ore had to travel an expensive fifty or sixty miles inland from the ports on Lake Erie, while coal had to come by rail from Pennsylvania.

With Tom M. Girdler at the helm as president, Republic set out to solve its water transportation problem and increase its steel-making capacity. Girdler, a steel-maker in the old tradition," put together a two-pronged deal that improved the company's access to the Great Lakes, gave it a better balance between its raw steel and finishing capacities, and boosted Republic's share of national steel making capacity from seven to nine percent. Republic acquired the Trucson Steel Company of Youngstown, the largest steel fabricator in the Midwest, and it acquired Corrigan, McKinney.

Trucson, which made mostly light building shapes such as window sash and doors, was a large consumer of semi-finished steel; the deal thus eliminated some of the business of Republic's competitors, since Republic could supply Trucson with nearly all of its steel needs. The acquisition of Corrigan, McKinney gave Republic a modern steel plant with an ingot capacity of one million tons a year, dock facilities at Cleveland, extensive enough to handle all of Republic's ore shipments, and fifty million tons of iron ore in Minnesota and Michigan--doubling the company's reserves. "These things are all worth having," Fortune commented when the deal had been consummated, "but the great virtue of the merger is that it takes Republic out of that miserably high-cost Mahoning Valley." Girdler thereafter could rely on the corporation's lake plants to produce cheap, unfinished steel, while the mills in the interior produce higher-priced specialty steels on which freight cost was less important a factor. The manuever put Cleveland at the hub of a wheel whose spokes radiated to Canton, Massillon, and Youngstown.[19]

The merger, which was challenged unsuccessfully by the Justice Department, reflected the steel industry's "inexorable trend toward integration," Tom Girdler later wrote.[20] As Girdler described it, Corrigan, McKinney in 1934 was faced with the problem of raising a large sum of money to build additional finishing mills to use the steel they were making. Republic,

on the other hand, needed more steelmaking capacity to take care of its numerous fabricating plants. Fortune magazine summed up the situation this way:

> Corrigan had more ore reserves on hand than it could use in fifty years, whereas Republic was shy on ore. Republic was light on pig iron while Corrigan had a phenomenally high ratio of pig iron to raw steel. Republic had a fairly high ratio of finished- to raw-steel capacity, while Corrigan had a very low rate.[21]

At the time of its merger with Republic, the Corrigan, McKinney plant included four blast furnaces, 204 by-product coke ovens, and 14 open-hearth furnaces, with the capacity to produce 1,116,000 gross tones of steel ingots each year. With its physical plant rounded out by its acquisitions, Republic Steel "could accurately be described as a new corporation" in 1935.[22] Republic moved its general offices from Youngstown to Cleveland the following year.

Republic Steel had managed to weather five years of losses since its formation on the eve of the Depression. The company enjoyed one important advantage: Republic, which sold half its production to jobbers, was primarily in the light steel business, producing finished, specialized, comparatively high-priced steels for use in the fabrication of consumer goods. By contrast, steel companies concentrating on the production of rails and heavy structural shapes suffered terrible losses when the demands of railroads and the construction industry plummeted.[23]

Business conditions showed a marked recovery in 1936. The improved economic outlook encouraged the company to accelerate its program of plant modernization. In 1937, Republic undertook the first major expansion of its Cleveland District steel plant with the erection of a 98-inch continuous hot strip mill, the largest of its kind in the world. The new mill, located nearly two miles south of the main plant, included related cold rolling, pickling, annealing, and shipping facilities. The project required the diversion of nearly a half mile of the Cuyahoga River. The old Corrigan, McKinney plant supplied the new mill with steel slabs.[24]

During World War II, government funds from the Defense Plant Corporation assisted Republic in the construction of a new blast furnace (No. 5) of 450,000 tons annual capacity, ore dock, power-house, and 75 coke ovens. These facilities were operated under government lease until Republic purchased them in 1950. The capacities of the older open-hearth furnaces were enlarged to 185 tons each to help meet the wartime demand for steel.

By 1945, the Cleveland District plant was capable of producing 1,570,000 tons of steel ingots each year. In response to the post-war demand for automobiles, appliances, and other steel products, Republic again renovated its open-hearth furnaces in 1948, adding a fifteenth furnace and raising the capacities of the fourteen others to 220 tons per heat.[25]

In 1950, work began on a $75 million plant expansion program. Included was the construction of a new blast furnace (No. 6) of 450,000 tons annual capacity; a second open-hearth shop housing four 275-ton capacity furnaces; and a new battery of 126 by-product coke ovens. In 1958, Republic added two open-hearth furnaces of 375-ton capacity, and the four furnaces erected in 1952 were each enlarged to the same size. Also constructed was a 45-inch Universal slabbing mill, including sixteen new soaking pits, and 153 coke ovens to replace the original Corrigan, McKinney batteries. Major modifications were made to the 98-inch hot strip mill. This major expansion project--thought to be "the largest single steel plant expansion project ever undertaken in Ohio"--boosted the plant's annual capacity to 3,490,000 tons of steel ingots.

Republic's last major expansion of the Cleveland District steel plant began in 1964, with the construction of two new basic oxygen furnaces (BOFs) and a new flat rolled steel complex. The new furnaces, with a combined annual capacity of more than three million tons, replaced the plant's fifteen open-hearth furnaces. The BOFs are housed in a five-story building, 264x697 in size. The first heat of steel from the new furnace was tapped shortly before midnight on 30 June 1966. The cold-roll strip mill, with related pickling, annealing, and shipping facilities, was completed in 1969. The 84-inch hot strip mill began production in January 1971, replacing the 98-inch mill, now abandoned and partially dismantled.

Making Steel in Cleveland Today[26]

Republic's Cleveland District plant is the largest of the company's six basic steel-making plants and one of the ten largest steel plants in the country. The plant sprawls across 798 acres on both sides of the Cuyahoga River. Approximately 7,000 workers, including increasing numbers of women, earn their livelihoods here. Products include hot rolled sheets and plates, cold rolled sheets, electrozinc-plated sheets, straight and coiled bars and special sections, and coal chemicals.

Coke Ovens

Coke is produced in the plant's six coke oven batteries. The ovens operate on a 17-hour basis and have a capacity to produce two million tons of coke each year. A half-mile-long conveyor spanning the Cuyahoga River delivers coke from the No. 1 coke plant to two of the plant's four operating blast furnaces (Furnaces Nos. 1 and 4, on the west side of the river). The bituminous coal used for coking is supplied by Republic mines in Pennsylvania, Kentucky, and West Virginia. By-products recovered from gases generated during coking are converted into coal chemicals--including benzol, toluol, xylol, and tar--in the plant's two refining facilities.

Blast Furnaces

Only Furnaces Nos. 1 and 4 still operate at the site of the original Corrigan, McKinney blast furnace plant. Furnace No. 1 is 198 feet high, No. 4 is 240 feet high; both have hearth diameters of 27 feet. Furnace No. 3, out of service but still extant, is 175 feet high with a hearth diameter of 17 feet, 3 inches. Furnace No. 2 was dismantled in 1973. Two furnaces, No. 5 and No. 6, operate at Republic's lower dock.

Iron ore, in the form of taconite pellets, come from Minnesota and Michigan and, in its natural state, from the Mesabi Range in Minnesota and the Labrador region of Canada. Iron ore is shipped to the plant in Great Lakes carriers where it is unloaded at one of two ore docks. Three Hulett unloaders operated at the lower dock, two at the upper dock. Limestone from Michigan is delivered to the plant in self-unloader boats and is stored at both docks and on a strip of land opposite the lower dock known as the "island."

Republic's Cleveland dock will no longer receive iron ore for all of the company's inland furnaces when a new dock accommodating self-unloader boats is completed next year (1980) in Lorain, Ohio. There, an underground conveyor will load about half of the anticipated 6.6 million tons of iron ore pellets into railroad cars for the trip to Republic's Mahoning Valley blast furnaces. The other half will be transferred to smaller boats for the trip to Cleveland.[27]

BOFs and Open-Hearths

Molten iron and steel scrap are refined into carbon steel in the plant's two basic oxygen furnaces (BOFs) and four open-hearth furnaces. Each BOF has the capacity to produce 245 tons of steel in less than fifty minutes. The open-hearths are capable of producing 400 tons of steel per "heat," each heat lasting from three to six hours, depending on the grade of steel being made.

Rolling Mills

Steel ingots weighing from 6 to 27 tons are heated to rolling temperatures in one of the plant's 41 soaking pits. The heated ingots receive their first rolling on the 44-inch blooming mill modified from its original 40-inches or on the 45-inch slabbing mill. Blooms, usually square or rectangular in cross-section, travel on rollers directly to the 21-inch mill and/or the 18-inch mill for further reduction into billets. The 21-inch mill, which originally had four stands of rolls, now has six stands. Slabs rolled from ingots on the 45-inch slabbing mill range in size from 4 to 9 inches thick, up to 32 feet in length, and from 27 to 78 inches in width; they are further processed into strips at the 84-inch hot strip mill and 84- and 98-inch cold mills.

The 10- and 12-inch bar, or merchant, mills added by Corrigan, McKinney in 1927 are still in use, rolling billets into a variety of rounds, flats, hexagons, squares, reinforcing bars, and other shapes. Bar products from Republic are used for the fabrication of bolts and nuts, wire, automobile parts, and other steel articles not requiring a large section.

The 10-inch bar mill was built in 1962. Today, "push-out" from the mill's two-zone, 32x45-foot continuous furnace is controlled by closed-circuit television, which monitors the billets inside the furnace. Rolling on the 10-inch mill is accomplished on a maximum of 14 stands of rolls for the smaller sizes and a minimum of 9 stands for the larger sizes.[28]

The 12-inch mill has been modified from 14 to 10 stands; there is no No. 6 stand, nor a No. 8 stand. The heavier sizes of rounds and squares are finished on stand No. 7, while smaller sizes and all flat products are finished on the last, or No. 12, stand. The bars today are turned automatically, doing away with the need for "stranders"--workers who formerly monitored the line and turned the hot bars with tongs to assure proper entry into the stands. The roller tables and broadside transfer (that shift the direction of the bar) are controlled by operators from two air-conditioned pulpits. The 12-inch mill has a three-zone, 32x65-foot continuous furnace equipped with a Fitch recuperator.[29]

Approximately 75 percent of the steel produced at the plant is rolled into strip on the 84-inch and 98-inch cold mills. The 84-inch hot strip mill features computerized control of steel width, thickness, surface flatness, and temperature. Slabs from the plant's 45-inch slabbing mill are reheated in one of two furnaces, then alternately pushed out onto rollers that carry them through the roughing and finishing stands. When it reaches the end of the line, the slab is a single strip varying in width and thickness

according to the customer's order. Water sprays cool the strip as it is automatically coiled. The finished coils are mechanically transferred to a conveyor belt, where they are marked by hand with an identifying number, then mechanically bound with steel bands.

In the adjacent cold mill complex, steel previously rolled in the hot mill is cleaned in a 750-foot hydrochloric acid pickling line to remove carbon deposits and mill oxides. After pickling, the steel is cold-rolled on a five-stand tandem mill with automatic gauge control. After cold rolling, the steel is annealed (softened) in computer-controlled annealing furnaces. The steel strip then makes a final pass through the 84-inch temper mill, which puts on the surface finish desired by the customer. The cold rolled coils are then processed through a 76-inch multiple slitting line for correct size and packaging.

Hot and cold rolled steel is shipped to customers in packaged coils or flat sheets and plates sheared from the coils. It is used in the manufacture of automobiles, appliances, office furniture, and other goods requiring a light-gauge steel of smooth surface.

Transportation

The River Terminal Railway, a wholly-owned Republic subsidiary, provides rail transportation within the plant. Its facilities include 78 miles of track, 29 diesel locomotives, numerous cars of all types, and maintenance and repair shops. The steel plant has direct connections with the B&O Norfolk & Western, and Newburgh & South Shore Railroads. Approximately 70 percent of the plant's finished products are shipped by truck, 30 percent by rail.

Power

Seventy-five percent of the plant's electric power is supplied commercially. The other 25 percent is generated by the plant's No. 1 power station. There are 10,000 electric motors, totalling over 485,000 h.p., in use throughout the plant. The largest of these is the 16,000 h.p. motor that drives the last roughing mill stand in the 84-inch hot strip mill.

The 44-inch blooming mill is still driven by the Mesta Steam Engine installed by Corrigan, McKinney in 1916. "Considerable interest to preserve the unit after it reaches the end of its useful and economic life....has been indicated by several historical societies," according to Republic.

Gas produced as a by-product of the coke oven and blast furnace operations is used within the plant to heat the blast furnace stoves, boilers in the power-house, and various reheating and annealing furnaces.

Water

Approximately 382,000,000 gallons of water are used daily. The majority of this, used for cooling, is drawn from the Cuyahoga River. Water for other than cooling purposes is purchased from the city of Cleveland.

Footnotes

1 Kenneth Warren, The American Steel Industry 1850-1970: A Geographical Interpretation (Oxford: Clarendon Press, 1973, p. 62; and Charles Langdon White, "Location Factors in the Iron and Steel Industry of Cleveland, Ohio, Journal of the Scientific Laboratories of Denison University 24 (April 1929): 91.

2 The early history of Corrigan, McKinney is best summarized in "Pioneer Ore Firm Adds Steel Mills to Its Large Furnace and Iron Mine Holdings," Iron Trade Review 61 (15 November 1917): 1043-1044; and Charles Longnecker, "Corrigan, McKinney Steel Company," Blast Furnace and Steel Plant 21 (January 1936): 75-76.

3 "From Ore to Iron to Steel is History of Cleveland District," Republic Reports, January 1947, pp. 4-5.

4 Cleveland Plain Dealer, August 1908. According to the Plain Dealer, "some of the property (purchased by Corrigan, McKinney) brought $10,000 an acre, the highest price ever realized on land in that district.

5 "Pioneer Ore Firm," pp. 1043-1045.

6 "The Corrigan McKinney New Steel Plant," Iron Age 100 (15 November 191): 1180. The description of the original Corrigan, McKinney steel plant, which follows, is taken largely from this article, pp. 1180-1186, and from "Pioneer Ore Firm," pp. 1043-1054, cited above.

7 These photographs are located in the Engineering Department, Republic Steel Corporation, Cleveland District Steel Plant, 3100 East 45th Street, Cleveland, Ohio.

8 "Corrigan, McKinney New Steel Plant," p. 1180.

9 "Pioneer Ore Firm," p. 1045.

10 "Corrigan, McKinney New Steel Plant," p. 1185.

11 Longnecker, "Corrigan, McKinney Steel Company," p. 79.

12 By "merchant mill" is meant a mill that rolls those common sections of rounds, squares, and flats that a steel merchant carried in stock. The term has evolved to mean a mill producing a wide variety of shapes, many of which never see a merchant's shelves. Modern mills producing these shapes are called merchant or bar mills. See Fred S. High, "Merchant Shapes," in Dan Reebel, ed., A B C of Iron and Steel, 6th ed. (Cleveland: The Penton Publishing Company, 1950), p. 195.

13 The description of the 10- and 12-inch bar mills is taken from Longnecker, "Corrigan, McKinney Steel Company," pp. 79-80, and from Republic Steel Corporation, Cleveland District, "10-Inch and 12-Inch Bar Mills" (mimeographed, 1975), p. 1.

14 High, "Merchant Shapes," pp. 195-196.

15 Longnecker, "Corrigan, McKinney Steel Company," p. 75. The company apparently had disposed of its fleet of lake vessels by this date.

16 "Republic Steel" ("Republic Steel II: Corrigan, McKinney"), Fortune, December 1935, p. 83.

17 Ibid.

18 William T. Hogan, Economic History of the Iron and Steel Industry in the United States, 5 vols. (Lexington, Mass., Toronto, and London: D. C. Heath and Company, Lexington Books, 1971), 3:1226.

19 "Republic Steel," Fortune, pp. 76-77, 144, 147.

20 Boot Straps: The Autobiography of Tom M. Girdler (New York: Charles Scribner's Sons, 1943), p. 221.

21 "Republic Steel," Fortune, p. 148.

22 Hogan, Economic History of the Iron and Steel Industry, 3: 1230-1231, 1234.

23 "Republic Steel," Fortune, pp. 81-82.

24 Hogan, Economic History of the Iron and Steel Industry, 3: 1235; and Warren, American Steel Industry, p. 222.

25 "Background Information, Cleveland District, Republic Steel Corporation," May 1967, revised July 1975 (mimeographed), p. 2. The account of the plant's expansion, which follows, is based on this report, pp.1-3.

26 Unless otherwise noted, the following description is based on "Background Information, Cleveland District," pp. 4-11, and a plant tour taken October 1-2, 1979.

27 Cleveland Plain Dealer, 14 October 1949, Sec. F, p. 1.

28 "10-Inch and 12-Inch Bar Mills," p. 3.

29 Ibid., pp. 4-5.

ADDENDUM TO
Corrigan, McKinney Steel Company
Cleveland
Cuyahoga County
Ohio

HAER No. OH-13

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