8 (1920)

The Manufacture of Merchant Bars

Description of the Processes and Mill Required in the Production of Merchant Bar at the Youngstown Sheet and Tube Company Plant, Youngstown, Ohio.

By A. E. JUPP.

THE product known as merchant bars is one used for countless purposes, thousands of articles being fabricated from this form of steel. The name comes from the fact that these bars were originally sold to merchants and by them disposed of to blacksmiths and other small users. The name has not been changed for 250 years, although originally there was little or no steel made in this form, bars being always made of iron.

Our merchant mills began operation in 1917. They take billets and small slabs rolled on other mills and form them into bars. The operation begins at a temperature of 2,200 degrees F.

Some sections and sizes require many passes through the rolls, others not so many. After the steel is rolled to the right size and shape, it passes to cooling beds, where it is slowly cooled in such a way as to prevent warping, and when this is done the bars pass on to shears, on which they are inspected,, weighed, and loaded on cars for shipment.

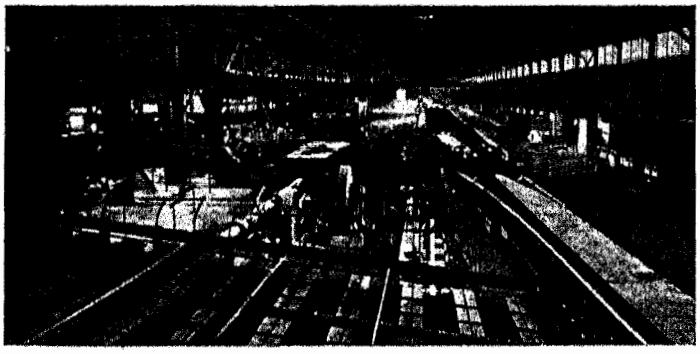

Fig. 1—Twelve-inch merchant mill.

We have two merchant mills, built by the Morgan Construction Company, Worcester, Mass. The 12-inch mill is designed to take billets 1½ to 3½, slabs 4x2 to 5x2, 30 foot lengths, and reduce them to finished sections of ⅞ to 2-inch rounds and squares, flats 1½ to 4½ and angles 1½x1½ to 3x3.

The capacity under normal conditions is 10,000 tons per month of average sections.

The 12-Inch Mill.

The 12-inch mill building is 100 feet wide by 1,150 feet long. One 15-ton single-hook crane serves the mill, and one 15-ton double-hook crane is used for stock handling. The buildings are of steel construction, and with the exception of the billet yard, have Pond type roofs, with swinging windows of steel sash and operating device. The roughing mill is a five-stand continuous train of 14-inch rolls, with an electrically driven dividing shear placed midway between the No. 2 and No. 3 stands. The four-stand 12-inch finishing mill is made of two trains arranged in pairs of two stands each, placed in a staggered position to one side and in front of the roughing mill. These roughing and finishing trains are driven by a Nordberg 44x50-inch uniflow engine of the poppet valve type, running from 65 to 100 rpm and developing up to 2,100 brake hp.

The cooling bed is 300 feet long, and is of the double universal type. Located at the end of the bed, and on each side are the roll straighteners of special design, having all driving gears mounted in oil-tight dust-proof housings, and without gears on the ends of the straightener rolls. Beyond the straighteners are located the 300-feet long front shear tables, bar shears, 75 feet back shear tables and scales where the material is sheared to desired lengths and weighed before shipping or stocking. A scrap shear is located near the mill end at the side of the cooling bed, while at the south end of the building in the rear of the back shear tables and scales is located a cross roll straightener for straightening rounds.

Electric current for operating the transfer tables, cooling bed, etc., is generated at the rod and wire power house. All control apparatus for operating the motors in this mill is concentrated in two control houses centrally located with respect to the motors.

The 9-Inch Mill.

The 9-inch mill was also built by the Morgan Construction Company, and is designed to take billets of 1¾x1¼ inches to 2¼x2¼ inch sections, in 30-foot lengths, and reduce them to finished sections of 11/32 to ⅞ inch rounds and squares, flats up to 2½ inches wide and angles up to 1½x1½ inches, with a capacity under normal conditions of 6,000 tons per month of average sections. The main 9-inch mill building is 90x1,175 feet, with a 24x600 foot shipping platform on the north side for the storage and shipping bundles. One 15-ton single-hook crane serves the mill, and one 15-ton double-hook crane is used for stock handling. The roughing mill is a six-stand continuous train of 12-inch rolls, with a steam-operated double-knife dividing shear in front of the No. 1 stand and a 30-foot side looping table between No. 2 and No. 3 stands, the shear and looping table are arranged for operating mill either single or double strand. This train is driven by a Nordberg 37x48 inch uniflow engine of the poppet-valve type, running from 65 to 110 rpm, and developing up to 1,500 hp. The six-stand finishing mill is made up of three independent sets of two stands each, placed in a staggered position to one side and in front of the roughing mill. Each set has an

(Continued on Page 515.)

Taken from Youngstown Sheet and Tube Bulletin.

line to pass directly into the exhaust line from the turbo and with this arrangement the blast temperature can be brought to any point desired.

If it is desired to operate the jet blower alone the valve plate H should be opened. Valves B, D and the blast gate G should be closed. Valve C should be opened wide and the regulating of the blower done from valve H. With this arrangement of valves the operation will proceed exactly as for the old jet blower.

Cooling Water.

In starting a new producer the top plate has a tendency to run hot and will usually require about all the water that can be applied through the three connections furnished. After a few days the top plate becomes coated with carbon and the quantity of the water can be considerably reduced. The overflow from the poker is usually sufficient for all purposes and this amounts to approximately 15 to 20 gallons per minute.

If for any cause the water pressure should be lost so that no water will flow through the poker, the producer should be immediately shut down and every effort made to keep the poker cool by means of an emergency line of steam or air. Caution should be exercised in starting the water to flowing through the system because if a large amount of cold water is allowed to strike the poker there is danger of the point breaking, making its replacement necessary.

The life of a poker tip is from six months to a year, depending considerably upon the condition in which the operator has kept his fires. This tip is a separate point screwed into the main barrel of the poker while the latter is heated to a cherry red color. This method of applying new tips should be used to prevent their working loose under the action of the fire. It is good policy to have a spare poker and trunnion changed if it is necessary to make a replacement during the operating period. This operation should not require more than 20 minutes.

Shutting Down.

In most installations there are periods when the furnace is down for repairs. This time should be taken to clean out the producer completely. The side walls should be cleaned, the blower and blast boxes cleaned out and any mechanical part needing attention should be repaired. This procedure, if carried out, will never amount to a great deal of labor and it will be more than repaid by the increased reliability of the machine and the success attained in its use.

Gas Making Conditions in the Producer.

The quality of producer gas depends upon its combustibles. The quantity and character of these are affected by the operating conditions within the producer. During the ordinary operation a battery of Wellman producers in a steel mill, 75 tests were made. Briefly stated, the following conclusions were drawn from these tests:

To make a rich gas, high in British thermal units, the ashes should be maintained at a height of a foot above the blast cover.

The combustion zone should be confined to a thin fire, approximately six to eight inches in thickness.

The green coal zone in which distillation of hydrocarbons (which enrich the gas) occurs should be kept from 12 to 18 inches thick.

Under these conditions the pressure of steam used for the blast should be 23 pounds per square inch.

Such operation produces gas in which a greater part of the calorific energy is due to its combustibles, rather than to its sensible heat. This is desirable as the heat losses during transmission to the point of consumption are less with a cool gas as compared with a highly heated gas.

The rate of gasification was 24.9 pounds of bituminous coal per square foot of producer cross section per hour, or 1960 pounds per producer per hour, as the consumption of gas did not require a higher rate at the plant under consideration.

The pitch of the curves of the diagram, together with the heat value of the gas, indicate what results will follow a departure from the most favorable operating conditions.

THE MANUFACTURE OF MERCHANT BARS.

(Continued From Page 523.)

independent motor drive, Nos. 7 and 8 stands being driven by a 700 hp motor at 450 rpm and Nos. 9 and 10 stands and Nos. 11 and 12 stands by 500 hp motors at 600 rpm.

The bar is repeated into all passes from the last roughing stand to No. 12 finishing stand. Snap shears are provided in front of each of the finishing passes, and small snap shears for test pieces are located in the runout trough to the cooling bed. The cooling bed, 460 feet long, is of the Edwards double-escapement type. Located at the end of the bed and on each side are the bar shears, back shear rabbles and scales, where the material is sheared to desired lengths and weighed before shipping or stocking. When the mill is rolling rods, or other material that requires coiling, the bar, after leaving the last finishing stand, goes to the rod reels, of which there are four, of the Edwards type with multiple disk drive and brake. The reels are belt driven from the finishing mill. The bundles are dumped from reels directly into a muffled conveyor, which delivers them to a bundle carrier 470 feet long, on which they are carried until cool. Scrap shears and a scrap-bundling machine are located near the mill end and at the side of the cooling bed, while at the south end of the building, near the warehouse, is located a roller straightener for straightening shapes. Electric current for operating the mill is from the same source as 12-inch mill.

A charging conveyor carries the billets from skids in the billet yard to the Morgan continuous heating furnaces, from which they are discharged to the roughing mill by means of a Hawthorne twist push-out. The furnaces use coke-oven gas or oil for fuel, the gas being piped from the Koppers by-product coke plant at East Youngstown. Both the 9-inch and 12-inch mills are served from a common billet yard and use a common warehouse for stocking purposes. The billet yard at the end of the mill is 90 feet wide and 594 feet long. It is served by one 15-ton double-hook crane and two standard-gage tracks for unloading material. The warehouse, at the south end, is 100x396 feet in size with one 15-ton double-hook crane and four depressed tracks for loading material from stock. A millwrights' shop is located within the mill building. All sanitary equipment, lockers and wash room are centralized.