Brick Sleeve Solves Tapping Problem

by H. H. Northrup

IN the Buffalo plant open hearth of Republic Steel Corp. the design and strength of ladle crane runways make it impractical to carry more than 130 tons of steel per ladle.

In 1937 a program was started to enlarge two of the nine furnaces, equip them with double ladle stands, and bifurcated spouts with flow regulating devices. This doubled the furnace capacity but presented steel quality, pouring, and delivery problems. These difficulties were met and overcome and three more furnaces enlarged, and equipped with bifurcated spouts in 1939, 1945, and 1951. The shop presently consists of five furnaces with bifurcated spouts averaging 250 tons per heat, and four furnaces with single spouts averaging 125 tons per heat.

The first of the many problems to be worked out with the installation of bifurcated spouts was one of accurately dividing the stream to fill both ladles evenly to prevent excessive pit scrap and off chemistry. Experience showed that a 10-in. diam brick sleeve placed slightly ahead of the division point of the spout would divert the stream into one leg or the other, provided the following items are checked prior to tapping:

A—That the width of each leg of the runner inside of brick lining at the point of division is held at 14 in. when lined. This allows a 12-in. opening when 1-in. of slurry has been added to each side of the spout between heats.

B—That the position of the divider is checked before tapping to be sure it will fall into the proper position to deflect the flow of steel as desired when lowered during tap. The action of the divider or flow regulator is one of deflecting the stream just before it gets to the point of division rather than plugging one or the other of the spout legs.

Positioning of the flow regulator in the runner while tapping is achieved by the use of an adjustable arm mounted above the taphole on a shaft connected to a remotely controlled wheel and gear. The flow regulator arm is hinged where it meets the control shaft so that this arm may be pushed from one side of the runner to the other to divert the stream of metal to the ladle desired. If the previously indicated checking is properly carried out with adjustments if necessary, it is possible to divert almost the entire stream to either leg of the spout, During the tap, the melter watches the rise of metal in the ladles from an elevated platform at one end of the furnace and gives instructions for placing the flow regulator to the crew below him. Experience in distribution of metal has been excellent and it is seldom that there is more than 10 tons difference in weight of the two ladles. Any difference can usually be attributed to difference in ladle capacities arising from wear on ladle lining.

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For a short time after the installation of bifurcated spouts, production on these furnaces was confined to reinforcing bar steel. It was thought that higher quality steels could not be successfully produced. Gradually this was proved wrong and for the past five years the size of the order has been the only determining factor in scheduling the furnace. In periods or reduced operation all grades of steel will be made in furnaces with bifurcated spouts.

Space for ladle additions is limited to one side of the ladle because of the bifurcated spout. Most of the production at present is killed steel in the medium manganese range, thus most of the additions, except silicon and aluminum, are normally made in the furnace. Should grades of steel produced change to those requiring larger amounts of ladle additions, chutes to handle this material can easily be installed.

Manganese additions for semi-killed or rimmed steels with the usually low manganese specification are shoveled into the ladle. This results in little variation between the two ladles, not too surprising when it is considered that a 10 pct difference in ingot weight on a 30 point addition would mean a variation of only three points from the mean.

Ladle additions of an exothermic nature must be limited because of fumes produced, which, depending on the speed of tap, obscure the height of steel in the ladles from the melter.

With five of nine furnaces of bifurcated design, the shop is commonly referred to as having a nine-furnace charging floor and a 14 furnace pit. To adequately handle the product of all furnaces and keep two ladles off for relining there are 17 all welded, 130-ton ladles. With recent results of a new practice of setting nozzles from the outside, it is believed that it will be possible to maintain the same production with a fewer number of ladles in service.

Four ladle cranes are sufficient usually, to handle the furnaces ready to tap. It is important that the pit foreman communicate with the senior melter many times during the shift. By planning in this manner, melters have been able to change grades of steel scheduled from one furnace to another to avoid heats tapping so close together that there is delay-waiting on ladle cranes. Planned weekly repair turns on ladle cranes are a *must* and breakdowns are thus at a minimum.

Because the three pouring platforms will hold only sufficient molds for the contents of seven ladles, it is apparent that at full operation each heat could not be held at the platform for the usual 80 min after finish pour. This problem was tackled with the help of the metallurgical dept. and it was found that if each half of the heat was pulled out of the pit within 5 min after finish pour and then allowed to stand outside until time to strip the hot top, the internal quality of the ingot was not adversely affected on most grades of killed steel.