because of a 400 ton stripping crane to strip the ingots. Poor mold life is experienced with this practice. Improved magnaflux has resulted. A good clean heat will still buy a lot of mold iron.

On the slab mold heats going to the strip mill, lower tapping temperatures are aimed for, and heats are teemed at about 2840°F. Because the metallurgists have sold the idea that the cause of blisters is from cold heats, an attempt is made to pour all stainless heats without a trace of ladle skull.

Correct pouring temperature is strictly an individual shop project. Many variables affect the out-

come such as: bath depth, stirring facilities, runner length and stream drop, ladle temperature, ladle size and shape, and teeming time.

Cleaner heats can be consistently made if the bath temperature is maintained at a high level throughout the refining period. Dirty heats are encountered when the bath is allowed to get too cold from large doses of final additions. The furnace is then pounded hard to get the bath up to the correct tapping temperature. This practice tends to give a stratified bath, hot slag, and an abnormal spread in temperature during teeming.

Temperature Control and Deoxidation For Electric Furnace Steels

by H. M. Parker

THE period from slag off to tap is the most important part of the heat cycle. This is especially true in respect to quality. Other factors being equal, it is generally agreed that the shorter the time from slag off to tap the better the quality. This is partially due to conditions that favor good quality being present and requiring little or no adjustment. Also corrective adjustments often fall short of the ultimate aim to the detriment of final quality.

Deoxidation Practices

Practices vary considerably between shops making the same grades of steel. Some deoxidize in the furnace, others entirely in the ladle. After the slag off the bath is thoroughly mixed either by reladling, rabbling, or by an induction stirrer to obtain a uniform bath from which representative samples are taken. It is the practice in some shops to deoxidize the bath immediately after slag off by immersion of aluminum or some other deoxidizer. Whether deoxidation is practiced or not after the slag off, a good basic slag is built up by lime and spar additions. The major alloying additions are made and melted in while waiting for results of the tests taken for residual elements.

These additions should be melted by the time the residual elements are known. From the residuals reported, final additions are computed. These final additions are made and should be of such minor nature as to require little melting time. The furnace helper during this period has been making any corrective additions to the slag that might be required. He also has tested by spoon or bar for temperature and increased or decreased power input so that by the time the final additions are melted the heat is ready to tap.

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Temperature Check

It is the practice in almost all shops today to check tapping temperatures by immersion thermocouples. Some use the thermocouple only as a check against the melter's judgment. Other shops rely entirely on the instrument reading and rigidly adhere to temperature ranges previously found to produce the best quality. These ranges will vary according to grade, size of heat, whether ingots or castings are being made and also whether direct, tun dish or bottom poured.

Titanium and aluminum bearing grades require special slag treatment. For titanium grades, the slag is removed just prior to tap to reduce the volume and a new slag is built up of burned lime and shot aluminum. The titanium may be added either in the furnace or in the ladle.

Slag is also removed prior to tap for aluminum bearing grades and thoroughly deoxidized with aluminum shot. This helps to obtain a more uniform recovery of the aluminum that is added in the ladle.

The hydrogen content of the bath must also be kept low to prevent excessive seams and blisters. Tests are taken prior to tap and if the hydrogen content is too high corrective measures are taken. In some shops the excess hydrogen is flushed out with inert gases. The present trend is to flush with dry air. The best practice is to prevent hydrogen pickup by controlling water leaks of the equipment and to use only dry materials after the slag off. When oxygen has been previously used to reduce the bath carbon, there is less likelihood of hydrogen trouble.

Some shops have special furnace deoxidation practices for some grades. Manganese and silicon are added in the furnace for practically all grades. Most deoxidation is accomplished in the ladle and varies according to the grade made. Silicon, aluminum, calcium-silicon, mischmetal, and rare earth compounds are the most commonly used materials.