

on their stability depends the life of the furnace. Having to stand the full force of the gas as it burns and sweeps across the hearth, carrying with it particles of oxide of iron and slag, they must be made of the most refractory material obtainable, generally chrome ore (with 45 % Cr_2O_3) or magnesite brick. The shape of the ports determines the direction of the flame across the hearth; faulty ports often allow the flame to shoot upwards toward the roof with disastrous results.

The silica brick of the walls and roof and other parts must be protected by a passive joint of chromite wherever it comes in contact with the basic part of the furnace, and if this joint is subject to pressure it must be protected from undue heating, the reason of this being of course the certainty of a fusible silicate being formed by the acid and basic materials present.

The operation on the hearth. When starting a new furnace, heat is applied slowly until the required temperature is reached, two and a half or three days after lighting—charging now begins.

The success of the modern open hearth process will depend largely on the ease and quickness with which the large amount of material is handled. Charging boxes are placed three on a buggy and are loaded in the stock yards by hand; in modern mills this is the only place where hand labor need be employed. The buggies with their boxes are run down a track in front of the furnaces lying between the charging machine track and the furnace front. Many experiments have been made to do away with the costly and arduous labor of hand charging, resulting finally in an electrical machine which works with such despatch and ease as to be really all that can be wished for. This machine can be run from one furnace to another and has four separate motions controlled by electric motors. The end of a long ram can be automatically attached to one end of the charging box, which is lifted with its load, run into the furnace, turned over, brought back and placed empty in its place on the buggy. In this way a furnace can be charged with fifty tons of material in less than thirty minutes. (See plate 1.)

The limestone in pieces of ten to twenty pounds, is charged first with a little ore: on this is dumped the pig metal, with some regard to distribution. For a fifty-ton furnace about which we are speaking the charge would consist of: limestone, 6,000 pounds; ore, 500 to 1000 pounds; metal, 45,000 pounds.

Gas is now turned on strong, and the furnace allowed to heat up to melting temperature, this taking about forty-five minutes. It is