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HOT TOP

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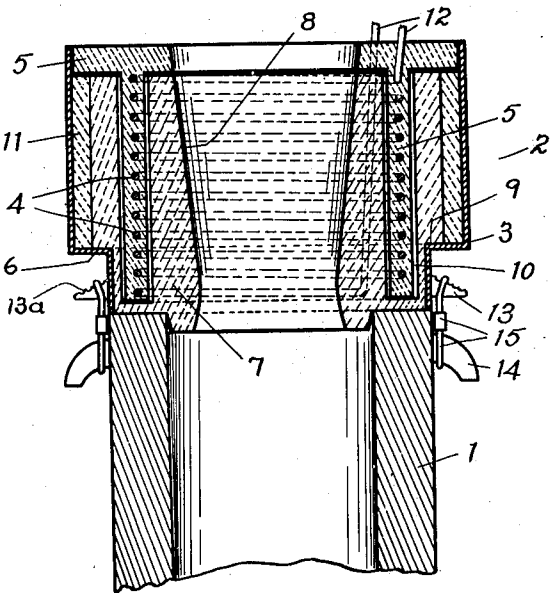


Fig I

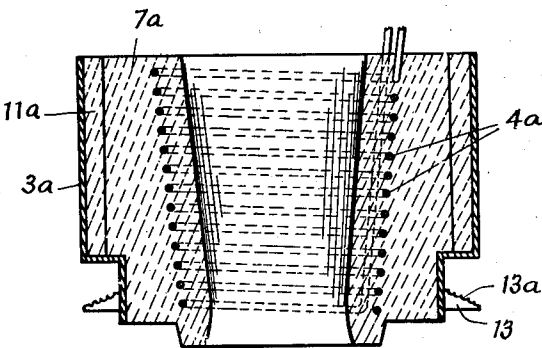


Fig II

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HOT TOP

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This invention relates to feeders or hot-tops for ingot-molds.

In mill practice it is customary to place a so-called hot top on the ingot-mold prior to the casting of an ingot of steel, or non-ferrous metals and alloys. A hot-top usually consists of a body of refractory material which is of such form as to provide, when the body is mounted over the open end of a mold, a continuation of the bore or cavity of the ingot-mold with which it is associated. When casting an ingot the molten metal is teemed to fill the bore of the hot-top, as well as the ingot-forming cavity of the mold proper. The several advantages incident to such use of hot-tops are well known. For example, the refractory material of which the hot-top is formed retards the flow of heat away from the upper end of the mold. Manifestly, this restraining of heat-flow retards solidification of the cast metal adjacent the upper end of the mold, and, in so doing, maintains for a sufficient period of time a portion of the metal within the hot-top in fluid state, while the lower portion of the ingot proceeds to solidify. Manifestly, gases forming within the ingot are free to escape through the molten upper end of the ingot, and the formation of so-called blow holes within the ingot is minimized. In like manner, impurities are free to move to the top surface of the ingot, and segregation of these impurities within the body of the ingot is effectively prevented. As in cooling the metal within the mold contracts, a central opening or pipe tends to form in the ingot, but the metal within the hot-top—the metal within the hot-top forming the so-called sink-head—feeds downwardly into the ingot and prevents the formation of such an opening.

The metal of the sink-head (the metal within the hot-top) cools first at its outer surfaces which lie in contact with the bore-surface of the hot-top, and the continued cooling and shrinking of the metal of the ingot proper effects the progressive subtraction of metal centrally from the sink-head. This progressive subtraction of metal from the sink-head ultimately results in the sink-head having a downward drawn cavity—a cavity shaped, in

general, as a vortex is shaped. Because of the cavity, the sink-head metal must be scrapped; this metal can not be rolled into sound blooms or billets, and, therefore, it must be sheared from the ingot.

The loss of metal, due to the shearing, is exceedingly great; it varies from six to fifteen per cent of the weight of the ingot. To minimize this loss, I propose to provide a heated hot-top, a hot-top including heating elements, and it is in a hot-top having this characteristic that my invention is found. Simplicity of structure, and low cost of manufacture are further objects in view. It is, of course, obvious to those skilled in the art that, if all of the metal within the hot-top is maintained in a molten condition, it (the metal) will sink into the ingot without forming the undesirable vortex. The necessary volume of the sink-head will, therefore, be no greater theoretically than the shrinkage volume of the ingot. No additional metal need be included in the hot-top to allow for solidification of metal adjacent the bore-surface thereof. Although my hot-top does not function to eliminate cropping or shearing, it does, however, greatly reduce the percentage of the metal, relative to the ingot, which must be ultimately cropped.

In the accompanying drawings Fig. I is a view in vertical section, showing fragmentarily the upper end of an ingot mold and showing the hot top of my invention associated therewith; Fig. II is a view in vertical section of a hot top of slightly modified structure.

Referring to Fig. I of the drawings the reference numeral 1 designates an ingot mold (fragmentarily shown) with which there is operatively associated my hot-top 2. The hot-top consists of an outer casing 3, conveniently formed of cast or sheet steel, within which casing there is retained heat-insulating material, and a heating element. The heating element, conveniently, consists of a coil of electric resistance wire 4. The wire 4 is embedded in a carrier 5 which may be molded of porcelain or other suitable electrical non-conductive, heat-insulating material. It will be observed that the casing 3 of the hot-top

is formed with a shoulder 6 continuous around the shell. The hot top includes an inner body 7, and this body 7 is formed with a shoulder 9 to fit shoulder 6 of the casing.

5 There is formed vertically through body 7 a bore 8 of such contour as to enhance the desired action of the molten metal in forming a sound ingot in the mold 2.

The carrier (5) of the heating element 4 is 10 removable as a unit from the recess 10 wherein the carrier is normally positioned. Removability of the carrier 5 is greatly to be desired, because, as in use the refractory body 7 wears away, as, indeed, it does wear away, the heating unit may be removed from the recess, and 15 a new body member 7 may be readily substituted.

The material of which the body 7 is formed should be of high refractory properties; it 20 should be particularly effective to store heat and resist heat-flow outwardly from metal within the bore 8. Suitable materials of this nature are known to the art. It is desirable to provide further insulation to decrease the 25 loss of heat due to radiation. A lining 11 of silocel lies between the metal casing and the body 7, and functions further to decrease heat loss.

The coil 4 of heating wire has its terminals 30 12 extending from the carrier 5, and suitable communication may be established with a source of electric energy to render the coil 4 effective to heat the surface of the bore 8 to a high temperature. The heating effect of 35 the coil may be controlled and maintained as desired through the instrumentality of well known electric control devices.

The hot-top casing 3 may conveniently be provided with lugs 13 which may be brought 40 to position immediately over the lugs 14; lugs, such as the lugs 14, are invariably formed on ingot molds to facilitate handling. It will be noted that the upper face 13a of each lug 13 declines outwardly, and is grooved or serrated transversely of its extent. Interconnecting each pair of lugs 13, 14 is a keeper 15, 45 to secure the hot-top to the mold, and each keeper 15 is in form a closed link which is hooked beneath one of the lugs 14, and swung to bring its upper end over the serrated surface of the associated hot-top lug 13. Obviously, by forcing the upper end of each 50 keeper 15 inwardly and upwardly on the face 13a of the associated lug, the hot-top may be secured tightly on the mold. The serrations or grooves in the faces 13a of the lugs 13 serve to secure temporarily the keepers in their adjusted positions.

In Fig. II, I have shown a hot-top consisting of a casing 3a, a band of silocel 11a, and 60 an inner body member 7a. This hot-top is contrasted to the first described hot top in that the heating coil 4a is embedded immovably in the refractory material of the inner 65 body 7a of the hot-top.

I have shown the bores of the hot-tops tapering downwardly an appreciable distance, and then curving outwardly in section. Obviously, to permit ready removal of the hot-top from the mold, and from the sink-head of the 70 ingot therein, it is essential that the sink-head during the cooling of the ingot, shall have receded or contracted to lie within the outwardly curving portion of the bore. However, the form of the bore is not of initial 75 concern, and it is to be understood that the form of the bore may be varied as the exigencies for such change arise.

I claim as my invention:

1. In a hot-top for ingot molds the combination with a refractory body having a 80 central bore, of electric heating elements positioned within said refractory body and adapted to heat the surface of said central bore, and a metal casing within which said 85 refractory body is removably supported, such assembled casing and refractory body with its heating elements being movable as a unit to a position on an ingot mold with the bore of said refractory body concentric with the bore 90 of the mold.

2. In a hot-top the combination of a metal casing, a body of refractory material formed with a central bore and positioned in said casing, a pocket formed in said refractory 95 body, which pocket is open at the top of said body and extends into the body substantially in parallelism with said bore, and an electrical resistor in said pocket for the heating of the refractory walls of said bore, which pocket 100 is so organized as to admit of the ready insertion and removal of said resistor.

3. In a hot-top the combination of a metal casing which is formed with a shoulder in its wall, a body of refractory material formed 105 with a central bore and positioned in said casing, said body of refractory material including a shoulder which seats on the shoulder of said metal casing, a pocket formed in said refractory body, which pocket is open at the 110 top of said body and extends into the body substantially in parallelism with said bore, and an electrical resistor in said pocket for the heating of the refractory walls of said bore, which pocket is so organized in the refractory 115 body as to admit of the ready insertion and removal of said resistor.

In testimony whereof I have hereunto set my hand.

JACOB M. ROTH. 120