

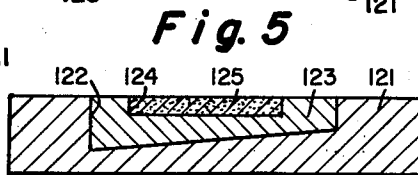
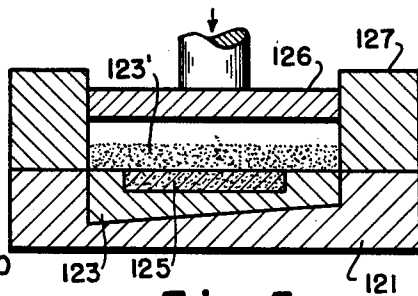
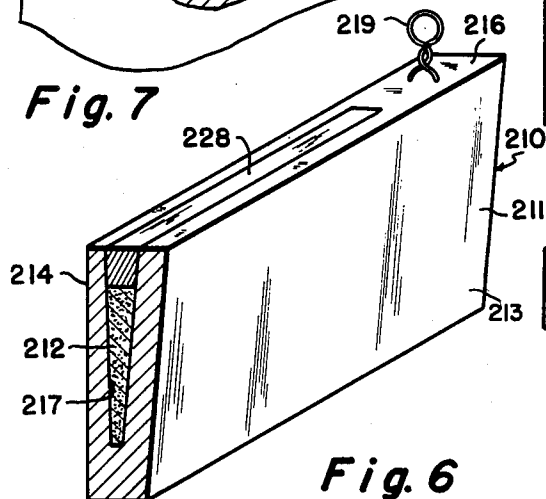
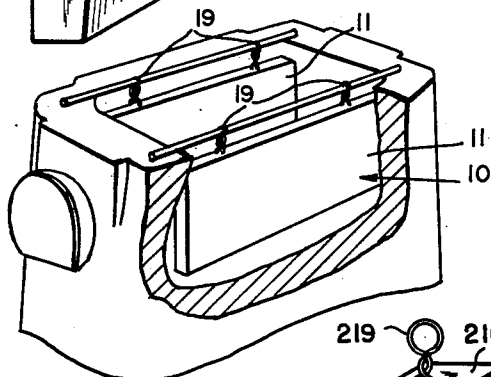
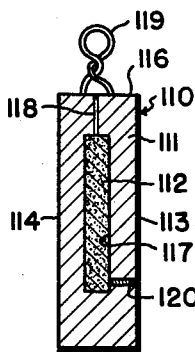
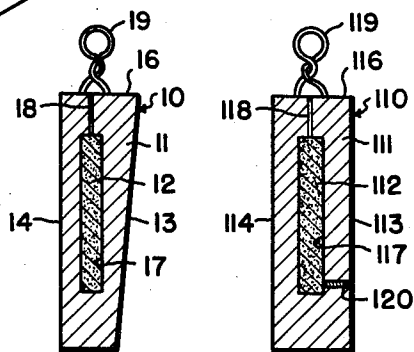
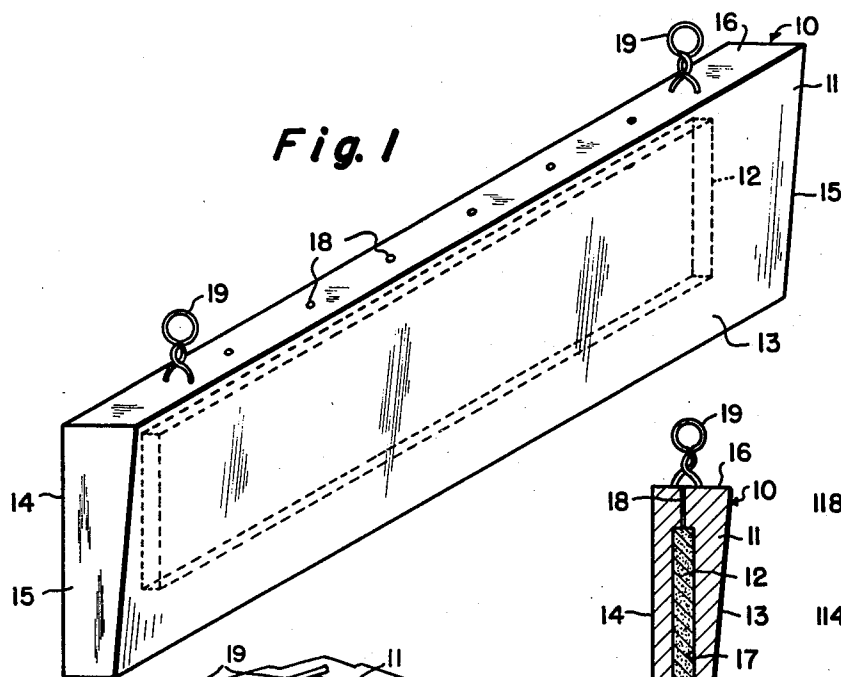
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EXOTHERMIC MATERIAL IN A NON-METALLIC REFRACTORY CASING

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EXOTHERMIC MATERIAL IN A NON-METALLIC REFRACTORY CASING

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This invention relates to apparatus and procedure for increasing ingot yield and more particularly to the production of composite heat imparting side boards capable of being located within the upper portions of the cavities of ingot molds during ingot pouring operations and maintaining a substantial quantity or reservoir of molten metal within the mold and thus preventing or minimizing the production of pipes and other detrimental cavities in ingots cast in molds so equipped.

An object of this invention is to produce composite exothermic side boards capable of being located within the metal receiving cavities of ingot molds and thereby maintaining a temperature condition within the molten metal during the pouring operation which will prevent or at least minimize the formation of pipes or other detrimental cavities in the ingots produced in molds so equipped.

A further object is to produce a refractory exothermic board which is simple and inexpensive to produce but which is highly effective when employed during the teeming of steel in accomplishing the production of ingots free from pipes or other objectionable cavities.

A further object is to produce simple and effective means for utilizing exothermic material in the production of sound ingots without subjecting the ingots involved, to the effect of contaminants which may be contained in the exothermic material.

A further object is to produce simple and effective means for encasing exothermic material in a refractory cover such that the exothermic material may be effectively employed in imparting heat to molten metal without subjecting such metal to the detrimental effect of such contaminants as may be contained in the exothermic material.

These and other objects of my invention will be apparent to those skilled in the art from the following disclosure and accompanying drawings in which:

FIGURE 1 is a perspective view of a side board assembly embodying my invention;

FIGURE 2 is a transverse sectional view of a side board such as shown in FIGURE 1, the section having been taken midway between the ends of the board;

FIGURE 3 is a similar sectional view of another form of side board assembly embodying my invention;

FIGURES 4 and 5 are longitudinal sectional views illustrating apparatus and indicating procedural steps employed in the operation of forming a side board assembly such as shown in FIGURES 1 and 2, the procedure there indicated also constitutes an embodiment of my invention;

FIGURE 6 is a perspective view of a transverse section of a side board assembly which also indicates another form of procedure for forming a side board assembly, in which the procedure and the board illustrated, both constitute embodiments of my invention; and,

FIGURE 7 is a perspective view of an ingot mold, with a portion shown broken away, and in which are suspended a pair of side board assemblies.

Referring now to FIGURES 1 and 2 of the drawings in which a composite exothermic side board assembly 10 is disclosed as comprising a refractory ceramic casing 11 of side board form, enclosing a mass of exothermic material 12 located in a cavity or chamber 17 formed in the board and extending lengthwise thereof. The casing 11

is preferably formed of highly refractory sand or some other refractory granular material which is highly refractory. As shown in the drawings, the housing or casing 11 may have a flat front face 13, a flat rear face 14, flat end faces 15, a flat top face 16, and a flat bottom face which is parallel or substantially parallel to said top face and like it extends substantially at right angles to the end faces 15. The front face 13 is shown inclined downwardly relatively to the rear face 14, thus producing a downwardly tapered side board.

The cavity or chamber 17 for the receipt of exothermic material 12, is formed within the casing 11. As shown, the casing 11 may be and preferably is, provided with a plurality of vent holes 18 extending downwardly from the top surface and communicating with the chamber 17, thus venting that chamber to the atmosphere. Two hanger supports 19 for the side board are shown with their support portions embedded within and extending upwardly from the top surface 16 of the casing. The exothermic material 12 located within the chamber 17 may either be employed in the form of a preformed slab or in the form of loose granular material, but in the side board shown in FIGURE 3 the exothermic material is in granular form since it is indicated as having been introduced into the chamber 17 through one or more apertures 120 formed in the board 110.

The composite exothermic side board assembly 110 is similar in many respects to the assembly 10; it comprises a refractory casing 111 having exothermic material 112 located within a cavity or chamber 117 formed within the casing 111. As shown, the chamber 117 is vented by providing vent passages 118 which extend from the top surface 116 and communicate with chamber 117. It is also equipped with hangers 119, the support portions of which are embedded within and extend upwardly from the upper portion of the housing 111. As shown in FIGURE 3, the housing 111 may have a rear surface 114 and a top surface 116 positioned similarly to surfaces 14 and 16 of the housing 10; however the front surface 113 of the housing 111 may be substantially parallel to the rear surface 114 rather than inclined to that surface like the surface 13 of FIGURES 1 and 2, is inclined to the surface 14.

A fuse or wick formed of exothermic material may be embedded in the casing of the composite board assemblies, embodying my invention and disclosed in FIGURE 3. The wick shown extends between the front surface 113 and the mass of exothermic material 112 located within the chamber 117 of the side board 111. Such wicks are not necessary to ignite the exothermic material located in the cavity 117, because the heat of molten steel in contact with the external surfaces of the board will ignite the exothermic material located within the board. This depends on the kind of metal being cast in the ingot mold and the type of exothermic material embedded in the side boards employed with the mold. It may be advantageous to employ such a wick to facilitate or expedite the early ignition of the exothermic material enclosed within side board assemblies such as illustrated in FIGURES 1, 2, 4, and 6. Wicks such as illustrated in FIGURE 3 are merely employed to ignite the mass of exothermic material within the side board and not as the board heating agent; it should be formed of a special type of exothermic material which will not contaminate the molten metal contacting the board.

The exothermic board assemblies may be produced by various ways, including a procedure employing the use of cores in the operation of casting the boards. FIGURES 4 and 5 illustrate apparatus and indicate one procedure for producing the exothermic board assemblies in which core casting need not be employed. FIGURE 4,

for example, illustrates a longitudinal section of a mold or former 121 having a mold cavity 122 filled with refractory material 123 which is in slab form. A portion of the refractory former 123 is shown recessed or hollowed out at 124 for the reception of exothermic material 125.

FIGURE 5 indicates procedure in which formed refractory material 123' such as illustrated in FIGURE 4, may be located in the cavity of a press member such as the member 121 shown in FIGURE 4. The member is covered by a layer of powdered refractory material 123'. The refractory materials may then be rammed into the press member so as to form a composite body of refractory material encompassing the exothermic material 125. The press as diagrammatically illustrated in FIGURE 5, discloses a ram or press member 126 which is forced down within the guides 127 to compress the refractory material into a unitary body and thereby form the companion member of the previously formed member 123.

The composite body is then baked at a temperature below the ignition point of the exothermic material, to set the binder in the refractory material. If desired, vent openings may be provided in the refractory material. When the CO₂ or cold-set method is employed to produce the composite assemblies, the ramming and baking operations are not employed since it is only necessary to fill and strike-off the mold.

FIGURE 6 illustrates another form of a composite exothermic side board assembly embodying my invention, wherein the assembly 210 comprises a refractory housing or casing 211 having an upwardly-open and downwardly-extending central cavity 217 which is filled with exothermic material 212. The housing 211 has a front face 213, a rear face 214, and a top surface 216. In use two hangers 219 are secured to and spaced along the top surface 216 of the side board and project into the interior of the board so that it is surrounded by refractory material.

A plug like closure 228 projects into the upper portion of the cavity 217 and encloses the exothermic material 212 within the housing 211. If desired, the closure 228 may be provided with vents similar to vents 118. The closure 228 is wedged-shaped and has a friction fit with the upper portion of the cavity 217 and may be easily removed so that the cavity 217 may be refilled with exothermic material.

In use, a pair of exothermic side boards are pendantly suspended within an upper portion of the cavity of an ingot mold so that they extend along opposed side walls of the cavity. Because of their weight and size the side boards may be manually hung in position without the use of overhead crane service, thus producing a saving in time and expense over that previously encountered with hot tops.

When the molten steel is teemed into the ingot mold and rises along the side boards, the heat of the steel ignites the exothermic material enclosed within the refractory casing of each side board. Further, the refractory casing encloses the exothermic material and as noted prevents it from contacting the molten steel in the ingot mold. When a wick or fuse, such as noted, is utilized,

the ignition of the exothermic material is expedited; however, due to a special non-contaminated mixture forming the wick and due to the fact that the main portion of the exothermic material is embedded within a refractory casing, the molten steel is not contaminated by the exothermic material or impurities in it. Vent holes may be provided in the upper surface of the refractory board, which is maintained above the upper surface of the molten steel in the ingot mold, so that gases emanating from the burning exothermic material may be vented to the atmosphere. The exothermic material in each side board may be in granular form or it may be preliminarily molded into slab form.

Although I have set forth my now preferred embodiments of my invention, it will be readily apparent to those skilled in the art that various changes and modifications may be made thereto without departing from the spirit and scope of the invention as defined in the accompanying claims.

What I claim is:

1. A side board for suspension from the top surface of an ingot mold, comprising a non-metallic, refractory portion and a portion of exothermic material, and hanger means comprising horizontal rod means extending, in spaced relationship, above and parallel to the top edge of said side board for direct support on said top surface and comprising downwardly extending rod portions suspended from said hanger means and integrally embedded within said refractory portion and constituting the sole means for supporting the side board, said portion of exothermic material being totally encased in said refractory portion, the top portion of said refractory portion being provided with an opening for introducing exothermic material, and a readily detachable plug for sealing said opening.

2. A side board for suspension from the top surface of an ingot mold, comprising a non-metallic, refractory portion and a portion of exothermic material, and hanger means comprising horizontal rod means extending, in spaced relationship, above and parallel to the top edge of said side board for direct support on said top surface and comprising downwardly extending rod portions suspended from said hanger means and integrally embedded within said refractory portion and constituting the sole means for supporting the side board, said portion of exothermic material being totally enclosed in said refractory portion, and a plurality of holes extending upwardly from said exothermic material through the top of said board for venting.

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