July 20, 1965 R. E. FERREE 3,195,853

CHILL MAT

Filed March 18, 1963

Fig. 1.

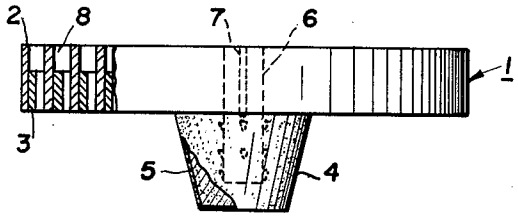


Fig. 3.

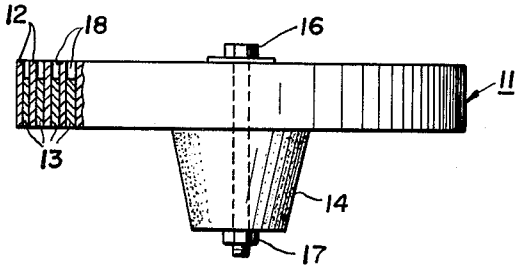


Fig. 2.

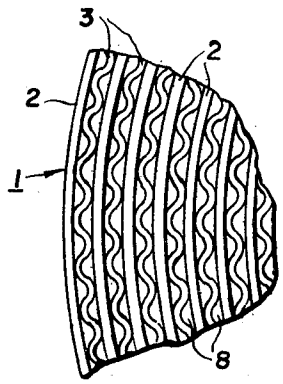
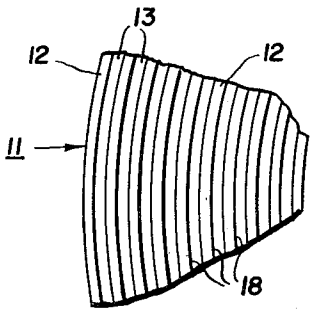


Fig. 4.



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CHILL MAT

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2 Claims. (Cl. 249—206)

This invention relates to a protective mat, sometimes called a chill mat, which is placed at the bottom of an ingot mold.

In the past, such mats were made of steel and were used for the purpose of protecting the bottom of the mold from erosion, also to protect the stool.

When it was desired to produce aluminum killed steel, the common practice was to kill the steel in the mold by dropping aluminum grain or shot in the mold or by suspending an aluminum bar by a mechanical device. These have not proved satisfactory in practice since frequently, the aluminum grains would immediately float to the top in the slag, also even distribution of aluminum throughout the ingot could not be achieved by these methods. There resulted an ingot which lacked homogeneity or uniformity, making it unsatisfactory for many uses.

An object of the present invention is to overcome the above-named disadvantages by providing a novel construction of chill mat serving not only the conventional purpose of preventing splash and erosion, but having an additional function of killing the molten steel poured into the mold and uniformly distributing aluminum (or other killing or alloying agent) throughout the entire mass of molten steel forming the ingot agent.

A further object of the invention is to provide an ingot mold insert having a novel ceramic plug construction assuring a perfect closure on the bottom of the mold and having a life many times greater than that of conventional plugs, and which is considerably cheaper and faster to manufacture.

Other objects and advantages will become more apparent from the following description of preferred embodiments of the invention, taken with the accompanying drawing wherein:

FIG. 1 is a side view of an ingot mold insert, showing portions of the metallic insert and attached ceramic plug, broken away to more clearly illustrate the invention;

FIG. 2 is an enlarged, fragmentary plan view of a portion of the insert shown in FIG. 1;

FIG. 3 is a side view, partly in cross-section, of a modification of the ingot mold insert construction shown in FIG. 1; and

FIG. 4 is an enlarged, fragmentary plan view of a modification of the structure shown in FIG. 2.

Referring more particularly to FIGS. 1 and 2 of the drawing, numeral 1 generally denotes an ingot mold insert or chill mat construction and numeral 4 denotes a plug attached thereto. The chill mat is a disc-like body comprising convolutions 2 of steel alternating with convolutions 3 of aluminum, or vice versa, there being appreciable spacing 8 between convolutions 2 by virtue of the fact that convolutions 3 are corrugated. These convolutions 2 and 3 are obtained by spirally winding a strip of steel and an adjoining strip of aluminum although it is possible, of course, to provide a plurality of concentric rings of steel alternating with a plurality of concentric rings of aluminum. Instead of aluminum, other equivalent metals or alloying agents may be used. Steel convolutions serve the usual purpose to eliminate erosion and splash of the teemed metal. The aluminum convolutions, to a certain extent, accomplish the same purpose, but their main purpose is to "kill" the steel in the mold and to provide very uniform distribution and concentration of the aluminum throughout the entire body of molten steel while in the mold. The aluminum convolutions 3 dissolve as the metal is teemed and rise in melted form in a uniform manner throughout the entire cross-section of the mold so as to become uniformly distributed in the teemed or molten steel because of the uniformity of distribution of the aluminum convolutions throughout the area of the chill mat.

While the aluminum is shown in the form of a spirally wrapped strip, it may be in the form of wire, rope or other form, so long as it is uniformly wrapped or distributed throughout the entire bottom surface of the mold.

In order to firmly hold down the chill mat on the bottom of the mold even after the aluminum convolutions melt, a plug 4 is provided which is attached to the chill mat in any suitable way. For example, a metal pin 6 may serve as a mandrel on which the convolutions are wound and has a depending, roughened portion embedded in a ceramic body forming plug 4. The pin is bifurcated at 7 so that the ends of the strips may be inserted therein for winding the convolutions 2 and 3 about the pin.

The plug 4 is preferably provided with an outer casing or coating 5 of zircon or other highly refractory material enclosing a main body of dolomite or other moldable, refractory and chemically stable material.

An objection of the conventionally used clay is that it must be baked for about two weeks and still does not provide a perfectly round shape, therefore forms an imperfect seal. Also, it tends to crumble or break up when subjected to teeming metal.

The presently improved plug eliminates these disadvantages and may be quickly molded to a perfect shape and by providing only an outer coating of very highly refractory material, such as zircon, the plug will withstand teeming without crumbling and will not cause non metallic inclusions, also the plug will be considerably cheaper than an all zircon plug. The coating 5 need not cover the entire outer surface but may cover only the top surface, or perhaps the sides and top. Coating 5 is preferably sprayed on the moldable refractory plug and is of greater density than the body. Instead of zircon, other very highly refractory materials may be substituted, likewise for the dolomite, other readily moldable, less refractory and cheaper materials may be substituted.

FIGS. 3 and 4 show a modification of the invention wherein the insert 11 comprises convolutions 12 of steel wrapped tightly against non-corrugated convolutions 13 of aluminum, between the convolutions. The only spacing 18 is provided between the top portions of convolutions 12.

The insert or chill mat 11 may be secured to the ceramic plug 14 by a bolt 16 and nut 17. Of course, other securing means, such as that shown in FIG. 1, may be used instead.

Instead of the aluminum in FIGS. 1 to 4 inclusive, any other alloying agent for providing a material to be alloyed to the molten steel, may be used instead. By uniformly distributing such agent throughout the area of the chill mat, upon melting and rising, the alloying agent will become uniformly distributed throughout the body of the ingot.

Although the aluminum or alloying agent is shown as a spirally wound coil, or concentrically wound rings, it may be in the form of separate segments uniformly distributed throughout the mat.

Thus it will be seen that I have provided a novel chill mat construction which not only prevents splash and erosion, but provides an additional function of releasing molten aluminum or an alloying agent so that it will rise uniformly throughout the entire area of the chill mat and in equal quantities and equal rates so as to become very uniformly distributed throughout the entire body of the resulting ingot.

While I have illustrated and described several em-

bodiments of my invention it will be understood that these are by way of illustration only, and that various changes and modifications may be made within the scope of the following claims.

I claim:

1. An ingot mold insert formed of a unitary body comprising a central plug of ceramic material having wound, therearound, convolutions of steel alternating with convolutions of lesser height of a different alloying metal having a lower melting point in contacting relationship, which convolutions are adapted to rest on and to become anchored by said plug to the bottom surface of an ingot mold and to cover substantially the entire bottom surface thereof, whereby said convolutions of steel will remain on said bottom surface while said different alloying metal will melt and form pools between said steel convolutions of greater height and rise substantially uniformly through the body of molten steel poured into the ingot mold.

2. An ingot mold insert as recited in claim **1** wherein said different alloying metal is aluminum which is corrugated longitudinally to provide a greater spacing between the steel convolutions.

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