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SPLASH MAT FOR INGOT MOLDS

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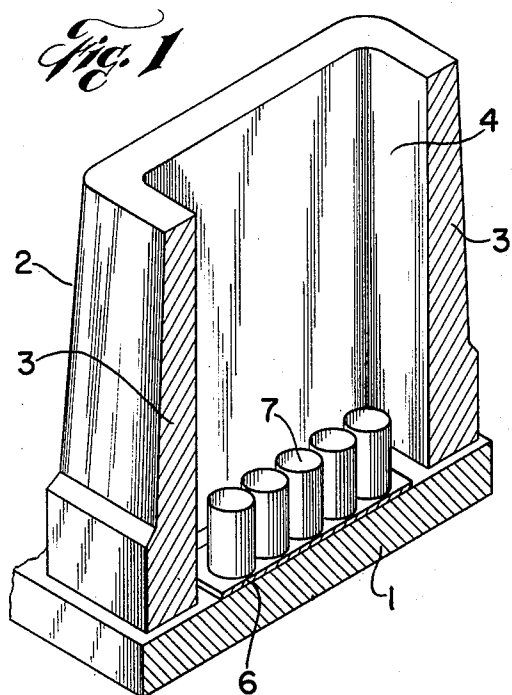
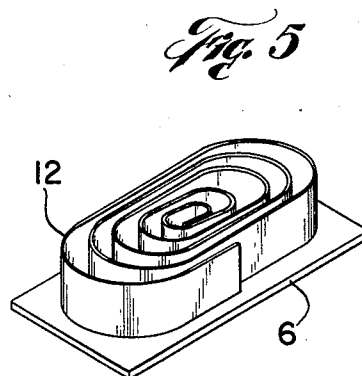
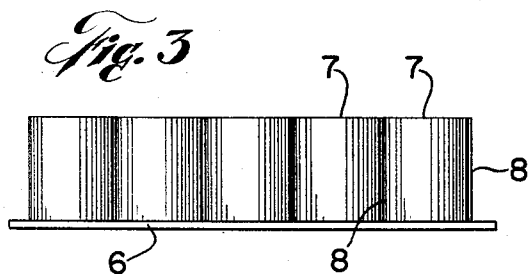
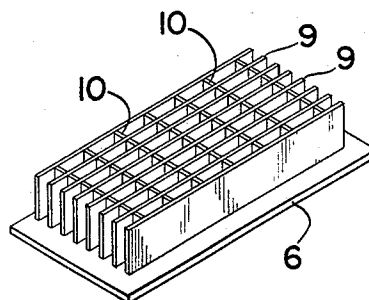
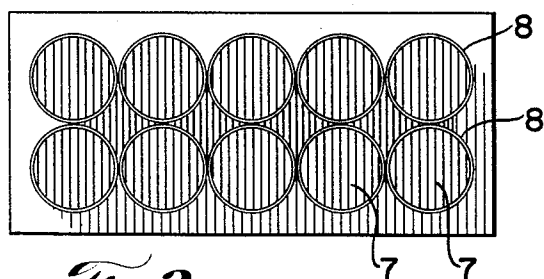


Fig. 4

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SPLASH MAT FOR INGOT MOLDS

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This invention relates to the art of casting steel ingots and is more particularly concerned with means for reducing the splashing and surging of molten steel during its teeming into ingot molds.

Steel ingots are conventionally cast by teeming molten steel from a ladle into the open top of an upright cast iron mold which is positioned upon a heavy cast iron base called a stool. The ladle of steel may hold an entire heat from an open hearth furnace, which may amount to 150 tons or so. The mold may be six feet or more high. The nozzle at the bottom of the ladle may have a diameter of from one and one-half inches to perhaps two inches. In teeming, the ladle is positioned so that the nozzle is more or less centrally located over the top of the ingot mold and is as close to the top of the mold as is practicable. When the stopper is raised, a compact stream of molten metal under the ferrostatic head of a full ladle strikes the stool with considerable force and splashes or rebounds in all directions against the lower portion of the inside mold wall. The molten steel coming in contact with the cold wall of the mold in this fashion chills or solidifies almost instantly. As the level of molten steel in the bottom of the ingot mold rises, the solidified splashes may be remelted. However, heavy splashes, particularly those solidifying on eroded or cracked portions of the inside mold wall, may not be remelted and remain on the finished ingot as scabs or undesirable surface imperfections. If the ingot stool is worn or hollowed out from use, such hollows may direct heavy splashes against certain portions of the ingot mold wall.

When a pool of molten metal of several inches depth has been formed in the bottom of the mold, it is able to absorb the energy of the falling stream of metal without dangerous splashing. However, the metal of this pool may itself surge or may be thrown momentarily against one wall or the other of the mold so that it may there chill and solidify at an appreciable height above its level surface. This surging may be caused by an irregular flow of metal through the ladle nozzle, by motion of the ladle relative to the mold during teeming, or by other occurrences. Here again the metal prematurely solidified on the mold wall may not be remelted by the molten metal rising in the mold, and so may produce scabs. Surging ceases to be dangerous when the pool of molten metal reaches a depth corresponding to a considerable fraction of the mold height.

It is an object of my invention to provide apparatus which may be positioned before teeming on an ingot stool within an ingot mold to minimize or eliminate the splashing of a stream of molten steel against the mold walls. It is another object to provide such apparatus which will minimize or eliminate surging of molten steel within a mold. Other objects of my invention will appear in the course of the following explanation and description.

Attempts have been made to deal with the problem of splashing during metal teeming by providing a liner for the ingot mold. Prior art devices of this type fall into

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one or the other of two broad classes. The first class includes liners conforming generally to the inside contour of an ingot mold and spaced a small distance from the mold wall. Those of the second class include liners into which the hot metal may be teemed having relatively small cross sections. These are spaced away from the mold wall and extend to or above the top of the mold. Both types of articles are, of course, melted by the molten metal rising in the mold and therefore must be supported from the top. This means that each must be designed for a specific size of mold and is not readily adapted to other mold sizes. Furthermore, the liners of the second class generally slow down the teeming of ingots by requiring the ladle to be spotted precisely over the relatively small liner opening. Neither class of devices has therefore met with general acceptance.

I have invented an apparatus which may be positioned on a mold stool, requiring no other support, and can be used without change in ingot molds of a considerable variety of sizes. My apparatus does not in any way increase in difficulties of ingot teeming.

Present preferred embodiments of the apparatus of my invention are illustrated in the attached figures, to which reference is now made.

Figure 1 is a perspective view on a vertical section through the center line of a mold, a mold stool, and a preferred embodiment of the apparatus of my invention.

Figure 2 is a plan view of the apparatus of my invention shown in Figure 1.

Figure 3 is a side elevation of the apparatus of Figure 2.

Figure 4 is a perspective view of another embodiment of my invention.

Figure 5 is a perspective view of a third embodiment of my invention.

A cast iron stool 1 supports a cast iron ingot mold 2 which has heavy side walls 3—3 and a smooth interior surface 4. The embodiment of my apparatus illustrated in Figures 1, 2 and 3 has a relatively heavy rectangular steel base plate 6 and a plurality of upright cylindrical steel walls 8 affixed thereto to form a plurality of contiguous open top chambers or shells 7 into which the molten steel may fall. The diameter of a shell 7 is less than half the width of the base plate 6. The embodiment of my invention illustrated in Figure 4 has a steel base plate 6 and affixed thereto a plurality of upstanding parallel steel strips 9—9 and a plurality of upstanding parallel steel strips 10—10 intersecting strips 9—9 substantially at right angles to form a plurality of rectangular open top chambers or receptacles. The embodiment of my apparatus illustrated in Figure 5 comprises a steel base plate 6 and a single elongated steel strip 12 coiled in the form of an open spiral and affixed to base plate 6 at one edge so as to form an open top spiral receptacle which acts in the same manner as a group of concentric chambers.

The operation of my apparatus will now be described with respect to the embodiment illustrated in Figures 1, 2 and 3. As may be seen from Figure 1, my apparatus is placed upon the ingot stool 1 so that base plate 6 is more or less centered on stool 1 within ingot mold 2. The ladle of molten steel is then spotted over ingot mold 2 in the usual manner and the stopper raised. The stream of steel from the nozzle will strike my apparatus at the bottom of the mold. This stream will either fall within one of my cylindrical shells 7 or it will be split by the vertical walls 8 of these chambers and fall in two or more. This splitting does not in itself cause any splashing. The stream of steel striking the base plate 6 of my apparatus will splash against the inside walls 8 of the shells 7 but, as these are high enough

to intercept the splashes, the latter will not reach the inside wall 4 of the ingot mold. Since the vertical walls 8 of my shells 7 are much closer to the stream of steel than the inside wall 4 of the ingot mold, they need not be very high to eliminate splashes. As will appear, I have found that in no case is it necessary to make the height of my shells 7 greater than about twice their minimum cross sectional dimension. By the time the shells 7 of my apparatus are full of molten metal, the pool of molten metal so formed is deep enough to absorb the energy of the falling stream of steel without producing dangerous splashing. The apparatus of my invention likewise prevents surging of metal in the bottom of the mold. The vertical walls 8 forming my shells 7 act as baffles to lateral movement of the molten metal.

Light gauge metal shells of any shape tend to float on the rising surface of the molten steel in the ingot mold if not prevented from so doing, and even though such shells melt rapidly, they may be responsible for splashes resulting from contact of the falling stream of metal with the solid shell surface. Such splashes are nearly always localized, as the turbulence of the rising metal seldom permits such shells to float horizontally. My base plate 6, which is firmly attached to my shell 7, prevents my apparatus while intact from floating on top of the rising metal, as the weight of the metal contained within my shells 7 holds the structure down. Eventually my device is melted by the molten steel in the mold. To prevent it from disintegrating prematurely, I have found it necessary to make my base plate 6 from considerably heavier gauge steel than my upright walls 8. The heat capacity of the heavier base plate 6 retards the melting of the shell wall 8 at the bottom, where melting, of course, begins, giving time for the molten metal to rise to the top of the shells, so that the whole shell tends to melt at about the same time. Although the temperature of the molten steel as teemed into the ingot mold is sufficient to melt my entire structure, so that its identity is completely lost in the ingot, the melting of even thin sheet metal in this molten steel requires a finite time. For the shell walls, therefore, I use steel of a thickness such that if not attached to my heavier base plate it would be melted at the bottom by the time it was filled with molten steel. For the base plate I use steel of a thickness such that it is not melted by the time steel has filled the shells. I find that low carbon steel about one-sixteenth inch thick is satisfactory for the shell walls 8, and low carbon steel about one-eighth inch thick is satisfactory for the base plate 6.

As I have mentioned, the nozzles used in teeming molten steel range from about one and one-half inches to about two inches in diameter. I prefer to make my cylindrical shells 7 from about five to about eight inches in diameter, so that a shell may easily receive the stream from the ladle nozzle and hold a pool of such molten steel until the shell is itself melted. The height of the shell walls 8 should not be less than their diameter and, as I have mentioned, need not be greater than about twice this amount. I have found that shells about eight inches in diameter and about fourteen inches high are, in fact, quite effective even for large slap molds. Ten such shells affixed in two rows of five each to a base

plate twenty inches wide by thirty-two inches long have been successfully used by me in a slap mold twenty-four inches by fifty-two inches in cross section, and seventy-two inches high.

The other embodiments of my invention described and illustrated herein function in the same manner as has been described. It will be observed that each of these is also constructed to present effective baffles to lateral surges of molten steel in the mold, and that each provides open top chambers into which the stream of molten metal may fall, these chambers having side walls positioned close enough to the stream that they intercept splashes which would otherwise reach the mold walls. The number and shape of these chambers may be varied in correspondence with the cross sectional dimension of the ingot mold in which the apparatus is to be used.

I claim:

1. Apparatus for casting metal ingots comprising a mold stool, an ingot mold positioned thereon, having a central opening to receive a stream of molten metal, and an antisplash device adapted to be melted by molten metal in the mold positioned upon said mold stool within said mold, said antisplash device comprising a metal base plate and upstanding metal side walls disposed to form a plurality of open-topped contiguous spaces having a horizontal cross section greater than that of the stream of molten metal and each adapted to receive a pool of molten metal therein, said base plate being thicker than said side walls, whereby said antisplash device melts without disintegrating.

2. Apparatus for casting metal ingots comprising a mold stool, an ingot mold positioned thereon, having a central opening to receive a stream of molten metal, and an antisplash device positioned upon said mold stool within said mold, said antisplash device comprising a metal base plate and upstanding metal side walls disposed to form a plurality of open-topped cylindrical shells, having a horizontal cross section greater than that of the stream of molten metal and each adapted to receive a pool of molten metal therein whereby said antisplash device is held against said mold stool.

3. Apparatus for casting metal ingots comprising a mold stool, an ingot mold positioned thereon having a central opening to receive a stream of molten metal, and an antisplash device positioned on said mold stool within said mold, said antisplash device comprising a metal base plate and upstanding metal side walls disposed to form a plurality of open-topped chambers each having a horizontal cross section greater than that of the stream of molten metal and each adapted to receive a pool of molten metal therein whereby said antisplash device is held against said mold stool.

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