CHILL PAD FOR AN INGOT MOLD
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9 Claims.

This application relates to a chill pad for an ingot mold and method of making same, particularly a chill pad for use in molds used in the steel industry for the pouring of steel ingots.

Ingot molds used in the steel industry for the pouring of ingots are well known and require no description. When the molten iron or steel is poured into the ingot, it has been found that the molten steel "washes out" the bottom of the mold. Devices known as "chill pads" have been placed at the bottom of the mold to prevent this effect of the molten steel on the bottom of the mold. The chill pad cools the first steel which is poured into the ingot and tends to solidify it and thus prevent the washing action.

One form of chill pad which has been very successful is made of iron or steel (generally steel) strip wound into a coil, with the turns of the coil spaced from each other. Generally, the coils have been made by coiling two steel strips together. One of the strips is transversely corrugated and the other is flat, and the corrugated strip acts as a spacer to hold the turns of the flat strip separated from each other.

A serious difficulty arises in the use of these steel strip chill pads in that occasionally when the steel is poured the chill pad will float up through the molten metal and thereby destroy the ingot.

I have invented a chill pad which utilizes a coiled steel strip but which also embodies means for preventing the coiled steel strip from floating up in the ingot. I form a chill pad of steel strip as just described and then weld a plate to one side of the coil. The plate and the coil are placed in the bottom of an ingot before pouring, with the coil on top of the plate. The coil chills the steel effectively as it has done in the past and the plate prevents the coil from rising up in the ingot metal.

Welding a plate to the side of a coil is a difficult operation. It cannot be done electrically because of the large area of contact between the plate and the coil. The coil cannot be brazed to the plate because that involves the use of metals other than iron or steel, and steel manufacturers insist that the chill pads be made only of iron or steel, in order to avoid contamination of the ingot metal. Moreover, brazing the coil to the plate would be a time-consuming and, therefore, expensive operation.

I have invented a method of making my chill pad which involves a simple casting operation which lends itself to mass production techniques and which, therefore, is relatively inexpensive. I place the coil in a foundry flask and cast a plate adjacent to it so that in a single casting operation the plate is both formed and welded to the coil.

In the accompanying drawings, I have illustrated certain present preferred embodiments of my inventions, in which:

Figure 1 is a plan view of a chill pad made of iron or steel strip which is similar to those which have heretofore been used and which forms part of my improved chill pad;

Figure 2 is a fragmentary vertical section of an ingot mold with my chill pad in place therein;

Figure 3 is a plan view of the coil shown in Figure 1 hold in position on a jig preparatory to being welded to a plate;

Figure 4 is a front elevation of the structure shown in Figure 3;

Figure 5 is a vertical section through the drag of a foundry flask showing the coil and jig of Figure 3 in position for casting the plate thereon;

Figure 6 is a vertical section of a cope of a foundry flask prepared for casting a plate which is to be welded to the coil shown in Figures 3 to 5; and

Figure 7 shows the drag and cope of Figures 5 and 6 assembled for casting.

Figure 1 shows a chill pad 8 made by coiling steel or iron strip such as has heretofore been used in the steel industry as described above and which forms a part of my improved chill pad. The pad is made up of two strips 9 and 10. The strip 10 is corrugated transversely so that when the two strips are coiled together the corrugated strip spaces the turns of the flat strip from each other. The size of coil depends upon the size of the ingot and generally extends a substantial distance across the bottom of the ingot.

As explained above, my improved chill pad embodies a flat plate which is welded to one side of a coil, such as is shown in Figure 1. Figure 2 shows my chill pad in position at the bottom of an ingot 11. It comprises a coil 8 of strip welded along one side to a plate 12. The chill pad shown in Figure 2 is for an ingot which has a hole 13 in its bottom and, therefore, the plate 12 carries a plug 14 which extends into the hole in the bottom of the ingot. Many ingot molds do not have such holes 13 and, therefore, of course, chill pads for such molds would not have plugs such as the plug 14.

When molten steel is poured into the ingot, it flows into and around the coil 8 and is chilled thereby. This effectively prevents washing of the bottom of the ingot and the plate 12 prevents the coil from floating up into the molten steel.

As above noted, I have also invented a process for welding the coil 8 to the plate 12. After forming a coil as is shown in Figure 1, I place it in a jig 15 (see Figures 3 and 4) which holds the coil in its coiled state. The jig 15 is a flat, rectangular plate having upwardly extending ledges 16 along two opposed sides. The coil is compressed along one diameter into an oval shape so that two sides of the coil will fit inside of the ledges 16. The inherent spring of the strips 9 and 10 will press the sides of the coil against the ledges 16 and hold it in position.

After the coil is placed in the jig, the individual turns of the coil are all tapped down against the plate so that the upper edges of the two strips 9 and 10 all lie substantially in the same plane. The jig and the coil are then placed in a drag 17 of a foundry mold or the like which has been filled with sand to a height that the upper edges of the strips forming the coil lie substantially flush with the top edge of the drag. Figure 5 shows the position of the coil in the drag. After the coil is in position, I pack additional foundry sand around the periphery of the coil and into the spaces between the two strips 9 and 10.

Any conventional foundry sand can be used and throughout this application when the word "sand" is used it is intended to refer to all types of mold materials which are used in foundry practice.

I then "strike off" the sand so as to expose the upper edges of the turns of the coil. Preferably, I also scrape the edges so as to clean them and thereby secure a better weld.

I next form in a cope 18 of a foundry flask, an impression corresponding to the plate which will be welded to the coil to form the chill pad. Figure 6 shows such a cope. It has an impression 12a corresponding to the
plate 12 of Figure 2, and an impression 14a corresponding to the plug 14 shown in Figure 2. The cope also has the customary sprue 19 and pouring basin 20. The impressions 12a and 14a can be formed by packing sand in the cope 18 around a pattern in accordance with standard foundry procedure, or a "permanent" cope can be used, i.e., a cope made of carbon with the impressions 12a and 14a permanently formed therein.

In accordance with usual foundry practice, the cope 18 is placed on top of the drag 17 and the two parts of the mold or flask are lined up by passing rods 21 through holes 22 in the flanges extending from sides of the two parts of the flask.

Molten iron or steel is then poured through the sprue 19 into the impressions 12a and 14a in the cope 18 to cast the plate 12 and the plug 14. As stated above, the upper edges of the individual turns of the strips forming the coil 8 are exposed and cleaned after the drag has been "struck off." Therefore, when the molten metal is poured into the cope, it comes in direct contact with the edges of the strips and melts the edges and thereby the edges of the strips are welded to the plate during the casting operation.

After the metal has cooled, the flask is taken apart and the plate which has been cast, together with the coil which is welded to the plate, are lifted from the flask and the sand is shaken out of the spaces between the strips 9 and 10. The jig 15 can be used again with another coil.

To be certain that the molten metal, when poured into the cope, will flow completely into the corners of the impression 12a corresponding to the plate 12, I find it advantageous to shield the turns of the strips forming the inner portion of the coil from the molten metal while it is being poured, so that the metal will not be chilled by contact with the central portion of the coil and fail to flow into the corners of the impression 12a. Therefore, before assembling the cope and drag of the flask, I paint the central portion of the coil with a conventional mold wash (indicated by the line 23 in Figure 5).

Instead of a mold wash I can place a core mold in the form of a thin circular disk on top of the central portion of the core and hold it in place by nails driven through the core into the sand filling the spaces between the strips of the coil, in accordance with standard foundry practice.

If a mold wash or a core mold is used, the central portion of the coil is, of course, not welded to the plate. However, I have found that welding the turns forming the outer portion of the coil is sufficient to hold the whole coil to the plate.

From the foregoing, it is apparent that I have invented a chill pad which effectively prevents "washing out" of the bottom of the mold when steel is poured and which will not float up in the molten ingot steel. I have also invented a simple, effective process for manufacturing the chill pad. The process lends itself to mass production techniques and, therefore, my chill pad can be made at relatively low cost. This is of considerable importance because the steel industry uses chill pads in very large quantities.

I have illustrated and described certain present preferred embodiments of my invention, it is to be understood that they are to be otherwise varied and practiced within the scope of the appended claims.

I claim:

1. A chill pad for ingot molds comprising a coil of metal strip, the individual turns thereof being spaced from one another and a solid homogeneous metal plate, at least some of the turns of the coil being welded on one edge to a surface of the plate.

2. A chill pad for ingot molds comprising a coil of metal strip, the individual turns thereof being spaced from one another and increasing in diameter, whereby the turns extend over a substantial portion of the bottom of the mold when the pad is in place in the mold, and a solid homogeneous metal plate, at least some of the turns of the coil being welded on one edge to a surface of the plate.

3. A chill pad for ingot molds comprising a coil made up of two metal strips, one strip being transversely corrugated and the other strip being flat, the two strips being coiled spirally together whereby the turns of the corrugated wire will space the turns of the flat strip from each other, and a solid homogeneous metal plate, at least some of the turns of the two strips being welded on one edge to a surface of the plate.

4. A chill pad as described in claim 3 in which said plate is welded to an edge of turns of the two strips forming part of the outer half of the coil.

5. A method of manufacturing a chill pad for an ingot mold comprising coiling metal strip with the individual turns of the coil spaced from each other, placing the coil in one part of a foundry mold with the edges on one side of the coil lying in substantially the same plane, packing sand around the coil and in the spaces between the turns of the coil, striking off the sand even with the edges of the coil which lie in substantially one plane, forming in a second part of the foundry mold an impression corresponding to a plate to be welded to the coil, joining the two foundry mold parts so that the edges of the turn of the coil substantially in one plane are opposite to the impression for the plate and pouring molten metal into the impression.

6. A method of manufacturing a chill pad as described in claim 5 in which the edges of the turns forming the central portion of the coil are shielded from the molten metal when it is poured.

7. A method of manufacturing a chill pad for an ingot mold comprising coiling metal strip with the individual turns of the coil spaced from each other, placing the coil in a jig whereby it is retained in its coiled state, placing the coil and the jig in one part of a foundry mold with the edges of the coil turns on one side of the coil substantially flush with an edge of the mold part, packing sand around the coil and in the spaces between the coil turns, striking off the sand even with the edges of the coil, forming in a second mold part an impression corresponding to a plate to be welded to the coil, joining the two foundry mold parts so that the edges of the coil which are even with the edge of the mold carrying the coil are opposite to the impression for the plate and pouring molten metal into the impression.

8. A method of manufacturing a chill pad for an ingot mold comprising coiling together two metal strips, one strip being flat, the other being transversely corrugated whereby the corrugated strip spaces the turns of the flat strip from each other, placing the coil in its coiled state in the drag of a foundry mold with the edges on one side of the coil substantially flush with the top edges of the drag, packing sand around the coil and in the spaces between the turns of the coil, forming in the cope of a foundry flask an impression corresponding to a plate to be welded to the coil, assembling the cope and the drag in alignment whereby the edges of the coil which are flush with the edge of the drag are opposite to the impression in the cope and pouring molten metal into the cope.

9. A method of manufacturing a chill pad as described in claim 8 in which the edges of the coil turns forming the central portion of the coil are shielded from the molten metal when it is poured.

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