July 26, 1966 R. S. HOSMER 3,262,669

ADJUSTABLE SURFACE CONDITIONER FOR INGOT MOLDS

Filed March 26, 1964

Fig. 1

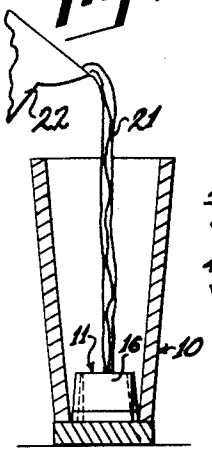


Fig. 2

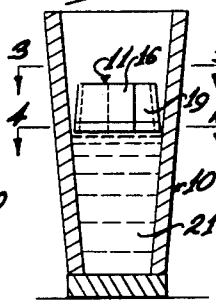


Fig. 4

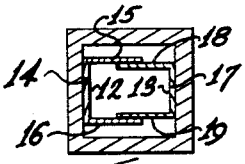


Fig. 5

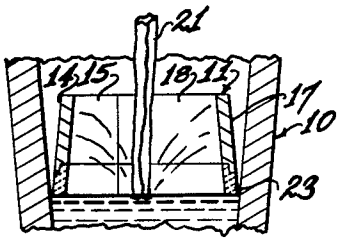


Fig. 3

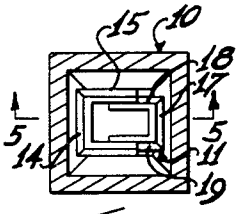


Fig. 6

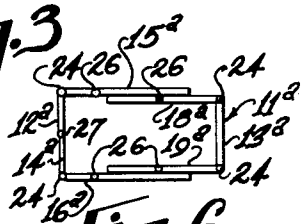


Fig. 7

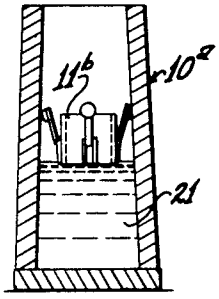


Fig. 8

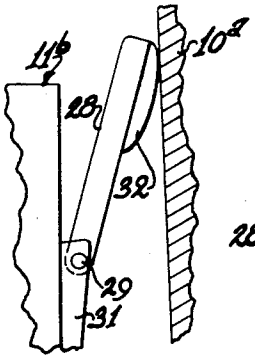


Fig. 9

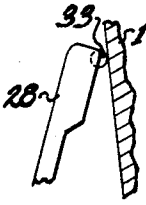


Fig. 12

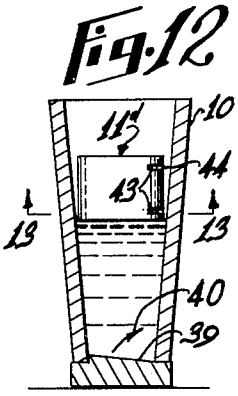


Fig. 10

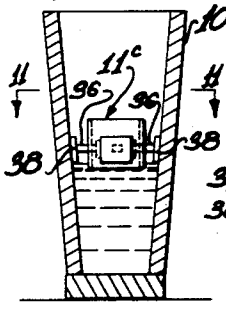


Fig. 11

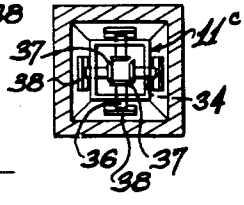
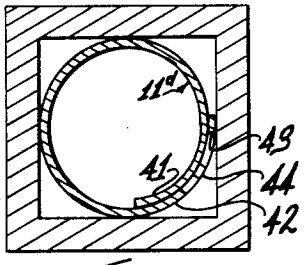


Fig. 13



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3,262,669

ADJUSTABLE SURFACE CONDITIONER FOR INGOT MOLDS

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4 Claims. (Cl. 249—197)

This invention relates to a self-adjustable surface conditioner for ingot molds and more particularly to a means for preventing molten metal from splashing onto the inner surface of a mold as it is poured therein.

An object of my invention is to provide a surface conditioner for ingot molds which shall include a sleeve-like member which is adapted to float on the surface of the molten metal as it is introduced into the mold, together with means maintaining constant contact between the surface conditioner and the inner surface of the mold whereby the surface conditioner moves upwardly in a generally straight line without lateral deflection relative to the inner walls of the mold.

Another object of my invention is to provide an adjustable surface conditioner for ingot molds of the character designated in which movable parts of the surface conditioner are self-adjustable in response to introduction of molten metal into the surface conditioner, thereby assuring satisfactory operation of the apparatus at all times.

A further object of my invention is to provide a surface conditioner for ingot molds of the character designated which shall be simple of construction, economical of manufacture and one which is particularly adapted for storage and shipment in knock-down form whereby the apparatus requires a minimum of space for shipment and storage.

Heretofore in the art to which my invention relates, various devices have been proposed to eliminate surface defects on ingots which are caused by molten metal being splashed onto the inner surface of the mold during the initial pouring operation. Such devices have included rigid sleeve-like members and the like which are positioned within the mold. However, such devices are unsatisfactory due to the fact that as the molten metal is poured into the mold, the sleeve-like member moves laterally in an irregular direction within the mold whereby the molten metal strikes the top or sides of the sleeve to thereby increase the splashing effect on the inner surface of the mold.

To overcome the above and other defects, I provide a self-adjustable, floating surface conditioner which is provided with means to maintain constant contact between the inner surface of the mold and the surface conditioner whereby the surface conditioner moves in a straight-line vertical direction as the molten metal is poured inwardly of the surface conditioner. Accordingly, the molten metal is always introduced adjacent to the central portion of the expandible surface conditioner.

Apparatus embodying features of my invention is illustrated in the accompanying drawing, forming a part of this application, in which:

FIG. 1 is a vertical sectional view of a mold having my improved surface conditioner therein and showing the position thereof during the initial pouring stage;

FIGURE 2 is a vertical sectional view corresponding to FIG. 1 but showing the position of the surface conditioner after some molten metal has been poured;

FIG. 3 is a horizontal sectional view taken generally along the line 3—3 of FIG. 2;

FIG. 4 is a horizontal sectional view taken generally along the line 4—4 of FIG. 2;

FIG. 5 is an enlarged, fragmental view taken generally along the line 5—5 of FIG. 3;

FIG. 6 is a top plan view showing a modified form of my adjustable surface conditioner;

FIG. 7is a vertical sectional view showing another modified form of my adjustable surface conditioner;

FIG. 8 is an enlarged, fragmental view, partly broken away and in section, showing the manner in which the outwardly projecting arms of the apparatus shown in FIG. 7 engage the inner surface of the mold;

FIG. 9 is an enlarged fragmental view showing another modified form of my invention;

FIG. 10 is a vertical sectional view showing a further modified form of my invention;

FIG. 11 is a sectional view taken generally along the line 11—11 of FIG. 10;

FIG. 12 is a vertical sectional view showing a still further modified form of my invention; and,

FIG. 13 is an enlarged sectional view taken generally along the line 13—13 of FIG. 12.

Referring now to the drawing for a better understanding of my invention, I show an ingot mold **10** which may be of a big-end-up type, as shown in FIG. 1 or the little-end-up type, as shown in FIG. 7. In FIGS. 1–5, I show the surface conditioner as being in the form of a sleeve-like member **11** which comprises two sections **12** and **13** which are of a generally U-shape, as viewed in cross section, as shown in FIG. 4. The section **12** comprises a base portion **14** and inwardly extending legs **15** and **16**. The section **13** comprises a base portion **17** and inwardly extending legs **18** and **19** which are adapted to slidably engage the legs **15** and **16**, as shown in FIG. 4. Preferably, the outer surface of the sleeve-like member **11** flares outwardly toward the lower end thereof, as shown, whereby any molten metals striking the inner surface of the sleeve-like member is directed downwardly and inwardly whereby it does not engage the inner walls of the mold. The molten metal, indicated generally at **21**, is introduced into the central portion of the sleeve-like member **11** by suitable means, such as a ladle **22**.

The lower portion of the sleeve-like member **11**, indicated at **23**, is preferably formed of a high temperature resistant material whereby there is no deterioration of the portion of the sleeve-like member **11** which is submerged in the molten metal. The lower portion **23** may be formed of any suitable material, such as a high-heat ceramic or refractory material.

From the foregoing description, the operation of the apparatus shown in FIGS. 1–5 will be readily understood. As the molten metal **21** is introduced into the upper end of the sleeve-like member **11** it engages the bottom of the mold **10** and thus splashes upwardly against the inner surface of the sleeve-like member whereupon it is directed inwardly and does not engage the inner surface of the mold **10**. As the molten metal is continuously introduced into the mold, the sleeve-like member **11** moves from the position shown in FIG. 1 to the position shown in FIG. 2 whereupon the sleeve-like member **11** expands due to the introduction of the molten metal inwardly of the sleeve-like member. That is, as the molten metal is introduced inwardly of the sleeve-like member **11** the slight build up of the molten metal inwardly of member **11** exerts an outward force on the inner surface of the sleeve-like member **11**. That is, as the sleeve-like member **11** moves upwardly in the big-end-up mold **10**, the sections **12** and **13** move outwardly relative to each other whereby the base portions **14** and **17** remain in constant contact with the inner surface of the mold **10** to thereby assure straight-line vertical movement of the sleeve-like member as it moves upwardly in the mold. Accordingly, the upper edges of the sleeve-like member **11** move in a straight-line vertical direction and do not move to a position beneath the downwardly poured metal **21**, thereby assuring that all of the molten

metal is poured inwardly of the sleeve-like member **11** and does not contact the upper or outer edges thereof.

In FIG. 6 of the drawing, I show a modified form of my invention in which a sleeve-like member **11a** is provided with sections **12a** and **13a**. The section **12a** is provided with a base portion **14a** and legs **15a** and **16a**. In like manner, the section **13a** is provided with inwardly projecting legs **18a** and **19a**. With each of the sections **12a** and **13a**, the base portions are hingedly connected to their respective leg portions as at **24**. Also, suitable hinge connections **26** are provided in the legs, as shown, whereby the outer surface of the sleeve-like member **11a** is adapted to conform to the inner surface of the ingot mold. Also, if desired, a hinge connection **27** may be provided in either of the base portions, as shown, to further accommodate the outer surface of the sleeve-like member **11a** to the inner surface of the mold.

In FIG. 7 of the drawing, I show a modified form of my invention in which a sleeve-like member **11b** is positioned within a little-end-up mold **10a**. Instead of the sides of the sleeve-like member **11b** moving outwardly or inwardly to accommodate itself to the internal dimensions of the mold, I provide a plurality of outwardly and upwardly extending arms **28** which are pivotally connected at their inner ends by pivot pins **29** to suitable brackets **31** carried by the sleeve-like member **11b**. The upper ends of the arms **28** carry suitable weights **32** whereby the outer ends of the arms bear firmly against the inner surface of the mold **10a**. Accordingly, as the molten metal is poured inwardly of the sleeve **11b**, it floats on the top of the molten metal **21** whereupon the arms **28** move inwardly in response to upward movement in the little-end-up mold **10a**. It will be apparent that the sleeve-like member **11b** is also adapted for use in a big-end-up mold.

In FIG. 9 of the drawing, I show the arm **28** as carrying a roller **33** in position to engage the inner surface of the mold **10a**. That is to say, the arm **28** may slidably engage the inner surface of the mold **10a**, as shown in FIG. 8, or be provided with the roller **33** which engages the inner surface of the mold.

In FIGS. 10 and 11 of the drawing, I show another modified form of my invention in which a sleeve-like member **11c** is mounted within a mold **10**. The sleeve **11c** is provided with openings **34** therethrough for receiving elongated support members **36**. The inner end of each support member **36** carries a baffle-like member **37** and the outer end of each elongated support member **33** carries a contact member **38** which is adapted to engage the inner surface of the mold **10** whereby the sleeve-like member **11c** is maintained adjacent the longitudinal center of the mold **10** as it moves upwardly therein in response to introduction of molten metal. That is, upon introducing molten metal into the upper end of the sleeve-like member **11c**, the molten metal engages the inner surface of the baffle-like member **37** whereupon the elongated support members **36** are moved outwardly and the contact members **38** engage the inner surface of the mold **10** at all times as the sleeve-like member **11c** is elevated therein in response to introduction of molten metal.

In FIGS. 12 and 13 of the drawing, I show a still further modified form of my invention in which a sleeve-like member **11d** is mounted within a mold **10**. The bottom of the mold **10** is provided with an inclined surface **39** whereby any molten metal engaging the same is directed in the direction of the arrow **40**, thus preventing any high splashing of the molten metal. While I have shown the inclined bottom **39** only in FIG. 12 of the drawing, it will be apparent that the inclined bottom **39** may be employed on all of the other molds.

The sleeve-like member **11d** is in the form of a cylindrical member having overlapped arcuate end portions **41** and **42**. The outside dimension of the sleeve-like member **11d** may be varied by merely causing relative sliding movement between the arcuate end portions **41** and **42**. To limit relative movement between the arcuate end portions **41** and **42**, I provide an elongated slot **43** in the arcuate end portion **42** and provide an outwardly projecting detent **44** on the adjacent surface of the arcuate end portion **41**, as shown in FIG. 13. The detent **44** thus projects into the slot **43** whereby it is adapted to move the entire length of the slot. Preferably, two of the arcuate slots **33** and pins **44** are provided, as shown in FIG. 12.

All of my embodiments operate in substantially the same manner in that the outer portion of the sleeve-like member, whether it be the sides of the sleeve-like member or the outwardly projecting arms **28** or contacts **38**, engage the inner surface of the mold so as to limit lateral movement of the sleeve-like member as it moves upwardly in a generally straight line. It will thus be seen that as the molten metal is poured inwardly of either of the sleeve-like members, the floating sleeve moves upwardly in response to the rise in level in the molten metal within the mold. The outer dimensions of the sleeve-like member remain in firm engagement with the inner walls of the mold regardless of the inner contour of the mold. That is, if the mold is a big-end-up mold, the overall size of the sleeve-like member **11** will increase as the elevation of the molten metal rises. On the other hand, with a little-end-up mold, the overall dimensions of the sleeve-like member will decrease as the elevation of the molten metal rises.

While I have shown the heat resistant material **23** as being applied only to the sleeve-like member **11**, it will be apparent that such may be applied to either of the other embodiments. Also, the entire sleeve-like member may be formed of a refractory material. Furthermore, if it is not desired to use the sleeve-like member for another pouring, the sleeve-like member may be formed of a combustible material whereby it prevents the splashing of metal onto the inner surface of the mold during the initial pouring stages and then decomposes during the latter pouring stages.

From the foregoing, it will be seen that I have devised an improved surface conditioner for ingot molds which automatically accommodates itself to the interval contour of the mold in which it is positioned. By providing an expandible sleeve-like member which is self-adjustable, the unit is adapted for use on all type ingot molds, thus eliminating the necessity of providing special units for the different type molds. Furthermore, by providing a surface conditioner which floats adjacent the top of the molten metal at all times, the major portion of the unit remains out of contact with the molten metal, thereby greatly increasing the life of the unit.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. A self-adjustable surface conditioner for ingot molds comprising:

(a) a generally rectangular, floating sleeve-like member having upstanding side walls and disposed to telescope inwardly of a mold in position to receive molten metal and float upwardly therein in response to introduction of molten metal into said sleeve-like member, and

(b) said sleeve-like member being composed of two sections, said sections being of U-shaped form in horizontal cross-section and being open at the top and bottom, the legs of one U-shaped section embracing the legs of the other U-shaped section in sliding relationship to permit expansion of said sleeve-like member in response to variation in the inside dimensions of the mold as the sleeve-like member floats upwardly.

2. A self-adjustable surface conditioner for ingot molds as defined in claim **1** in which portions of each U-shaped

section are hingedly connected to each other whereby each section is adapted to conform to the inner surface of the mold as molten metal is introduced into the sleeve-like member.

3. A self-adjustable surface conditioner for ingot molds as defined in claim 1 in which the portion of the sleeve-like member which engages the molten metal is formed of a high temperature resistant material.

4. A self-adjustable surface conditioner for ingot molds as defined in claim 1 in which the floating sleeve-like member is provided with a downwardly flaring inner surface.

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