Nov. 4, 1941. A. R. ROWE 2,261,289

FEEDER FOR CASTING INGOTS

Filed March 28, 1939

Fig. 1.

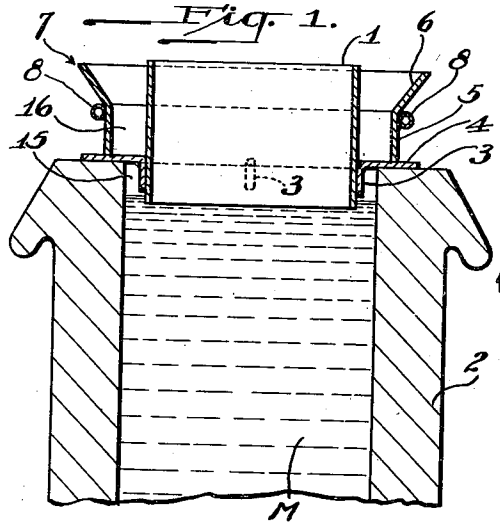


Fig. 2.

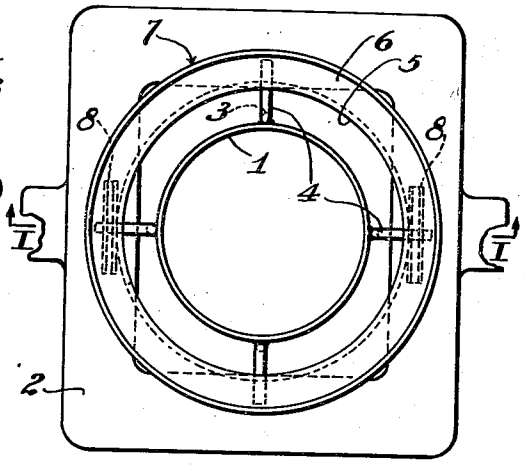


Fig. 3.

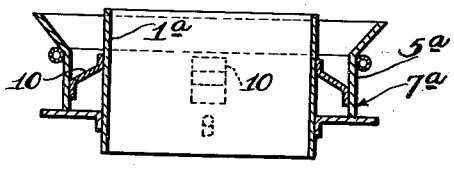


Fig. 4.

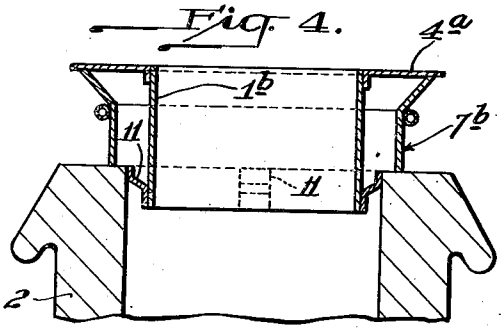


Fig. 5.

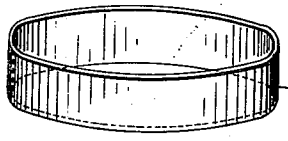


Fig. 6.

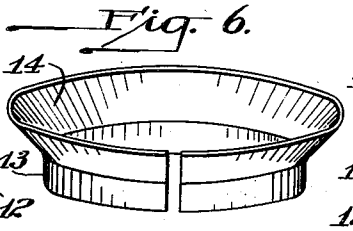


Fig. 7.

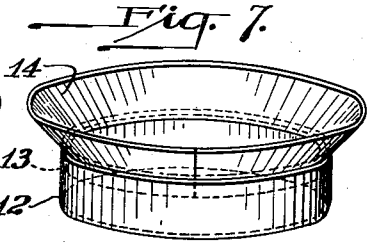
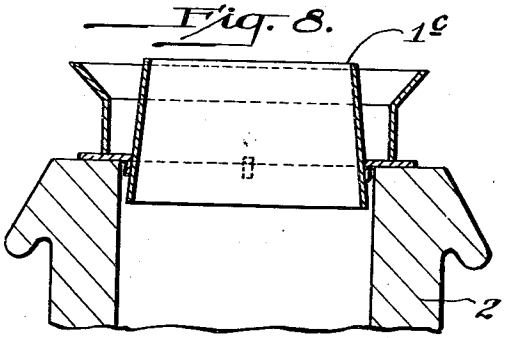


Fig. 8.



INVENTOR.
Andrew R. Rowe
BY
Brown, Critchlow & Flick
his ATTORNEYS.

Patented Nov. 4, 1941 2,261,289

UNITED STATES PATENT OFFICE

2,261,289

FEEDER FOR CASTING INGOTS

Andrew R. Rowe, McKeesport, Pa., assignor to Harbison-Walker Refractories Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application March 28, 1939, Serial No. 264,564

11 Claims. (Cl. 22—147)

This invention relates to feeders, or hot tops, for use in the casting of metallic ingots.

It is among the objects of this invention to provide a feeder for ingot molds which is light, sturdy, and easily handled and used, which requires a minimum of labor in handling, whose use does not interfere with standard ingot practice, which avoids run-downs and is capable of eliminating, or largely eliminating, piping of the ingots, is cheap and readily made, and of which part is used repeatedly and the other part is recovered as useful metal. Other objects will appear from the following description.

The invention will be described with reference to the accompanying drawing in which Fig. 1 is a vertical sectional view, taken on line I—I, Fig. 2. through the upper end of an ingot mold provided with a feeder in accordance with this invention; Fig. 2 a plan view of the mold-feeder assembly shown in Fig. 1; Fig. 3 a vertical sectional view through a modified form of feeder; Fig. 4 a vertical sectional view similar to Fig. 1 showing another modification; Figs. 5 and 6 perspective views of the elements of yet another embodiment of one part of the feeder provided by the invention; Fig. 7 a perspective view of the sleeve part assembled from the elements shown in Figs. 5 and 6; and Fig. 8 a view similar to Fig. 1 showing still another embodiment of the invention.

The invention provides a two-part feeder of the type comprising a tubular sheet metal feeder member and a surrounding sleeve member. The feeder member is adapted to have one end inserted in the opening of an ingot mold with a portion projecting above the mold, and it is of such sectional shape and size as to form a space between the feeder and the mold walls for receiving heat-insulating material. Preferably, the lower end of the feeder lies close to but out of contact with the mold walls. The other part of the feeder comprises a sleeve member adapted to be supported on the top of the mold. It surrounds the portion of the feeder member which projects above the mold and forms with it an annular space for receiving heat-insulating material.

A major feature of the invention is the provision of the upper end of the sleeve member with a collar which flares upwardly and outwardly from the sleeve and serves to guide insulating material into the annular space between the sleeve and feeder and thence into the space between the feeder and mold walls, and also permits ready and rapid introduction of such granular material and its uniform distribution without particular care being taken and without danger of introducing the insulating material into the interior of the feeder member.

Having reference now to the drawing, Figs. 1 and 2 show the application of the invention to the making of ingots in a mold having a generally rectangular opening. The feeder comprises a tubular member 1 made from sheet metal and of such size that it can be inserted into the opening of an ingot mold 2 to have a portion disposed above the mold and a portion projecting into the mold and forming a space 15 between it and the mold walls. Preferably, feeder member 1 is of such size that its lower end lies close to but out of contact with the mold walls. Although the section of the feeder may correspond to that of the mold opening, it is preferred for most purposes to make the feeder cylindrical, as seen in Fig. 2, in which event its diameter will be somewhat less than the least dimension of the mold opening.

The feeder shown is provided with means for suspending it within the mold opening. Although this may be accomplished in a wide variety of ways, I now prefer to provide the exterior of feeder 1 with lengths of wire welded at their lower ends to the feeder so that they may be bent outwardly to provide supporting members. As shown in Figs. 1 and 2, wires 3 are welded at their lower ends to the feeder and are bent outwardly to provide supporting members 4 which engage the top of the ingot mold. An advantage of this type of suspending means is that the wires can be made of considerable length so that they can be bent outwardly at a point appropriate to have any desired proportion of the feeder within the mold. The wires should be, of course, sufficiently strong to suspend the feeder until its lower end has been frozen into the upper surface of the ingot, as described hereinafter.

Surrounding feeder 1 is a tubular sleeve member 7 comprising a body portion 5 having at its upper end a collar 6 that flares widely upwardly and outwardly. In the embodiment shown the body portion is cylindrical and its diameter is such as to provide a relatively large annular space 16 surrounding the portion of feeder 1 which projects above the mold top. As seen particularly from Fig. 1, the sleeve member is carried on the mold top.

In the use of a feeder, or hot top, as thus provided by the invention the feeder assembly is applied to the mold, either before or after teeming, with the feeder member 1 suspended in the mold so that its lower end is covered by metal M cast

within the mold, as seen in Fig. 1. When the metal at the surface has solidified sufficiently, granular insulating material is introduced into the sleeve member 7 to fill the space provided between the feeder and the mold walls and that surrounding the projecting portion of the feeder member.

A major advantage of the invention flows from the provision of the outwardly and upwardly flaring collar portion 6 of sleeve member 7. Experience in the use of sleeve members that are continuously cylindrical from end to end has shown that although they are capable of reducing or eliminating piping, particularly when used in processes identified hereinafter, considerable care must be taken in introducing the heat-insulating material to prevent the material from falling outside of the sleeve member or into the inside of the feeder member, which may be objectionable in some instances. Also, it may be difficult to quickly fill the space uniformly. These difficulties arise largely from the fact that the annular space 16 may be, and usually is, rather narrow, say three inches. With such continuously cylindrical sleeve members the addition of the insulating material is therefore a slow operation, and it is rendered more difficult by reason of the intense heat conditions at the time the material is added. On the other hand, the widely flaring collar provided by the invention makes it possible rapidly and easily to introduce the heat-insulating material, as with a shovel or from a spout, without the disadvantages just mentioned. Furthermore, it tends to effect uniform distribution of the insulating material through all of the space which is to be insulated.

For similar reasons the use of cylindrical feeders and sleeve members is preferred because they make it easier to completely and uniformly fill the spaces than where the parts are made generally rectangular. The use of a circular feeder member has the particular advantage that it provides for the use of larger volumes of heat-insulating material in space 15 within the mold than where the feeder is of a cross section generally similar to that of the mold opening, which is desirable because it affords better insulation for back-poured metal.

After the ingot has solidified the sleeve member 7 is removed and may then be used with a new feeder member 1 to provide an assembly such as shown in Figs. 1 and 2 for casting another ingot. The feeder member welds to the neck which is formed by solidification of the residual back-poured metal and accordingly is recovered when the neck portion is cropped from the ingot in its working. Thus through recovery of the feeder portion in remelting and through continued reuse of the sleeve member substantial economies result from the feeders of the present invention as compared with those used heretofore.

The sleeve member is preferably provided with means for lifting it readily from the mold. A preferred means is indicated in Figs. 1 and 2 as comprising a pair of short lengths 8 of pipe welded diametrically of the sleeve member at the junction of the collar and body portions. When the sleeve member is to be removed a pair of bars may be inserted on in each pipe as levers for lifting the sleeve member upwardly and away from the ingot and mold.

The feeder provided by the invention is, of course, capable of being modified in a variety of ways. A desirable modification is to provide one of the members with spring means adapted to engage the other member for holding the two members in axial alignment. In the embodiment shown in Fig. 3 the sleeve member 7a is provided with spring fingers 10 suitably connected, as by welding or riveting, to the inner wall of the body portion 5a. By spacing these spring members uniformly they engage feeder member 1a when the feeder is assembled to automatically position and maintain the two members concentrically. This assures the provision of a uniform space around the feeder member for reception of insulating material, thus insuring that metal within the feeder member is uniformly insulated around its entire periphery.

It is desirable, of course, to have the feeder member likewise in axial alignment with the mold opening. This may be accomplished manually in the setting of the feeder assembly shown in Figs. 1 and 2. However, in another modified embodiment the feeder member is provided adjacent its lower end with spring means adapted to engage the mold walls to automatically effect axial alignment of the feeder relative to the mold opening. This is exemplified in Fig. 4 in which spring fingers 11 are welded or otherwise suitably connected to the lower end of the feeder member to function in the manner just stated.

Suitably both the sleeve member and the feeder member are provided with spring means as shown in Figs. 3 and 4. In such a modified embodiment the sleeve and feeder members will be axially aligned relative to each other and the feeder assembly will be axially aligned relative to the mold. For most purposes it is preferred to use four such spring members disposed at 90° intervals about the periphery of the element to which they are attached.

Fig. 4 illustrates yet another embodiment of the invention which differs from that shown in Figs. 1 to 3 in that the feeder member is suspended from the upper end of the sleeve member instead of directly from the mold. As shown in Fig. 4, feeder member 1b is provided with suspending means 4a connected near the upper end of the feeder to extend over and rest upon the upper end of the sleeve member 7b and thus suspend the feeder member therein. The sleeve member rests directly on the mold top. In such an embodiment the suspending means 4a should be sufficiently flexible to permit their being bent upwardly to allow removal of the sleeve member after the ingot has solidified. This embodiment has the advantage that the entire feeder may be assembled and handled as a unit prior to being placed on the mold.

The sleeve member illustrated in Figs. 1 to 4 may be made unitary or, as illustrated in Figs. 5 to 7, it may be made from a cylindrical member 12 of sheet metal or plate which acts as the body portion of the sleeve member and which receives a split collar member shown in Fig. 6. This collar, formed from sheet metal, comprises a short neck 13 adapted to be received within the upper end of member 12, and an upwardly and outwardly flaring portion 14 which provides the collar portion of the sleeve. To assemble this sleeve member the split collar portion is contracted by slipping the split ends past one another sufficiently to permit insertion of neck 13 into member 12. When the ends are released the collar member will thus spring into place and provide a sleeve member in accordance with the invention as shown in Fig. 7.

For many purposes the lower end of the feeder

should be close to but a substantial distance from the mold walls, and experience has shown that for casting ingots of large section, say 22 x 25 inches, space 15 is desirably about 1½ inches wide at the lesser axis of the mold. It will be understood, however, that the lower end of the feeder member may approach quite close to, or even touch, the mold walls. For example, the feeder 1c shown in Fig. 8, generally similar to that shown in the preceding drawing, is of such size that its lower edge lies almost in contact with the mold walls, say ¼ inch therefrom.

The invention has been shown as applied to the pouring of big-end-up ingots. In the casting of such ingots it is necessary for the feeder member to project a substantial distance above the top of the mold, as shown in Figs. 1 and 4, to provide a relatively long neck of solid metal for engagement by tongs in removing the ingot from the mold. The invention is equally applicable to the casting of small-end-up ingots, and for such purposes it is not necessary to have the feeder extend as far above the top of the mold as in the case of big-end-up ingots. In such instances a greater proportion of the feeder may lie within the mold than is shown in the drawing, to accord with the customary practice of pouring small-end-up ingots and as will be understood by those skilled in the art. To take care of these variations in mode of use, or to permit the making of cuts, the feeder member may be supported with a greater or lesser proportion of its length within or outside of the mold as the case may be.

Also, although the invention has been described with particular reference to the use of cylindrical feeders with molds having generally rectangular openings, it will be understood that it is applicable to the use of cylindrical feeder members with mold openings of circular, or non-rectangular, section as well as to the use of feeders of generally rectangular section with molds of corresponding section.

The sheet metal feeder member may generally be made from relatively light-gauge metal, say 16-gauge sheet iron, for most purposes. The sleeve member may be, and preferably is, of relatively heavy section to avoid damage or breakage and to permit its continued reuse. Although the space between the feeder and sleeve members may be varied according to need, I now believe that for many purposes satisfactory results are to be had by proportioning the two members to provide a space several inches wide, say three inches, between them, i. e., between the feeder member and the body portion of the sleeve member.

The feeder provided by the invention may be used for the casting of ingots according to any desired practice. Thus, the ingot may be teemed and the feeder assembly then set in place, due regard being had to having the lower end of the feeder member extend into the molten metal in the mold. Or, if desired for any reason, either the feeder member or the entire feeder assembly may be placed on the mold and the ingot then teemed through the feeder member. As soon as the metal has solidified sufficiently to prevent the insulating material from sinking into the metal, granular insulating material is added to fill the space 15 between the feeder and the mold walls and the space 16 between the feeder and the sleeve member.

The feeder provided by the invention is adapted particularly for use in the practice of the processes disclosed and claimed in my copending applications Serial No. 258,389, filed February 25, 1939, and Serial No. 261,210, filed March 11, 1939. In the practice of those processes the ingot is teemed, using a two-part feeder and granular insulating material as described generally hereinabove. Promptly upon the completion of the teeming operation the metal within the feeder is covered with a heat-insulating cover slab of combustible material of low mass-to-volume ratio which becomes charred or ashed during solidification of the ingot but which resists complete destruction for a substantial period of time. After the metal initially cast has frozen the lower end of the feeder in place, which prevents run-downs in back-pouring, and preferably after a shrinkage cavity has formed at the upper end of the ingot and the cover has been ashed, at least to some extent, but before the initially cast metal has frozen completely, the ingot is back-poured by pouring a further amount of molten metal into the feeder member to provide a large body of molten metal for feeding the ingot during the subsequent stages of solidification. Most suitably the feeder is filled in the back-pouring operation. The ash formed from the cover floats on the surface of the back-poured metal and insulates it against unduly rapid loss of heat, while the granular insulating material surrounding the feeder member acts in the same way to retard loss of heat laterally of the feeder, thus maintaining the back-poured metal molten long enough to feed the ingot during its final solidification. In this manner any pipe or shrinkage cavity is confined to the neck of metal within the feeder member.

The cover material is preferably in the form of a slab prepared by bonding combustible material, most advantageously wood excelsior in the form of coarse and long shavings, with a suitable refractory binder, advantageously a heat-resisting cement such as magnesium oxysalt cements, examples of which are magnesium oxysulfate and magnesium oxychloride cements. Wood shavings are particularly suitable for this purpose because they provide a base which is itself a poor conductor of heat, and because they can be formed into a slab having desirable porous and heat-insulating character, while the shavings will burn, or char, slowly to provide a layer of ashes which continues to maintain a heat-insulating coating as described but which permits ready back-pouring.

In the practice of the invention disclosed in my application Serial No. 258,389 the space between the feeder and the mold and the sleeve is filled with sand or the like granular material of suitable heat-insulating character, while the invention of my application Serial No. 261,210 is directed specifically to the use of granular to finely divided coke, advantageously what is known as coke breeze.

According to the provisions of the patent statutes, I have explained the principle and mode of practicing my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The combination with an ingot mold of a two-part feeder comprising a tubular sheet metal feeder member weldable to metal cast therein

and having its lower end inserted into the mold opening and forming with the walls thereof a space for receiving heat-insulating material, and having a portion projecting above the mold, and a tubular sleeve member open at both ends and supported on the top of the mold and surrounding the projecting portion of said feeder member, the upper end of said sleeve member being provided with a collar flaring upwardly and outwardly therefrom, and the sleeve member cooperating with said feeder member to provide a space for receiving heat-insulating material.

2. The combination with an ingot mold having a generally rectangular opening, of a two-part feeder comprising a cylindrical sheet metal feeder member weldable to metal cast therein and having its lower end inserted into the mold opening and close to but spaced from the walls to form a space for receiving heat-insulating material, and having a portion projecting above the mold, and a tubular sleeve member open at both ends and supported on the top of the mold and surrounding the projecting portion of said feeder member, the upper end of said sleeve member being provided with a collar flaring upwardly and outwardly therefrom, the sleeve member cooperating with said feeder member to provide a space for receiving heat-insulating material, and one of said members being provided with spring members engaging the other member and maintaining them in axial alignment.

3. A two-part feeder for use in casting metallic ingots, comprising a sheet metal tubular feeder weldable to metal cast therein and member of such length and size as to be adapted to be inserted into the opening of an ingot mold and to form a space between it and the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring upwardly and outwardly.

4. A two-part feeder for use in casting metallic ingots, comprising a sheet metal tubular feeder member weldable to metal cast therein and of such length and size as to be adapted to be inserted into the opening of an ingot mold with its lower end forming a space with the mold walls, and with a portion projecting above the mold; and a surrounding tubuluar sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring upwardly and outwardly; and spring means associated with one of said members for engagement with the other member to align them axially.

5. A two-part feeder for use in casting metallic ingots, comprising a sheet metal tubular feeder member weldable to metal cast therein and of such length and size as to be adapted to be inserted into the opening of an ingot mold to form a space between it and the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly; and spring means associated with at least one of said members for engagement with the other member and for engagement with the mold walls and acting to align said members axially of each other and of the mold opening.

6. A two-part feeder for use in casting metallic ingots, comprising a sheet metal tubular feeder member weldable to metal cast therein and of such length and size as to be adapted to be inserted into the opening of an ingot mold with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly; and means associated with the feeder member for suspending it from said sleeve member.

7. A two-part feeder for use in casting metallic ingots, comprising a sheet metal cylindrical feeder member weldable to metal cast therein and of such length and diameter as to be adapted to be inserted into the opening of an ingot mold with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly.

8. A two-part feeder for use in casting metallic ingots, comprising a sheet metal cylindrical feeder member weldable to metal cast therein and of such length and diameter as to be adapted to be inserted into the opening of an ingot mold with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a detachably mounted collar portion flaring widely upwardly and outwardly.

9. A two-part feeder for use in casting metallic ingots, comprising a sheet metal cylindrical feeder member weldable to metal cast therein and of such length and diameter as to be adapted to be inserted into the opening of an ingot mold with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly; and spring members associated with the interior of the body portion of said sleeve member for engagement with said feeder member to align them axially.

10. A two-part feeder for use in casting metallic ingots, comprising a sheet metal cylindrical feeder member weldable to metal cast therein and of such length and diameter as to be adapted to be inserted into the opening of an ingot mold

with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly; spring members associated with the interior of the body portion of said sleeve member for engagement with said feeder member to align them axially, and spring members associated with the exterior of said feeder member for engagement with the mold walls to align said member axially of the mold opening.

11. A two-part feeder for use in casting metallic ingots comprising a sheet metal cylindrical feeder member weldable to metal cast therein and of such length and diameter as to be adapted to be inserted into the opening of an ingot mold with its lower end close to but out of contact with the mold walls, and with a portion projecting above the mold; and a surrounding tubular sleeve member open at both ends and having a body portion adapted to be supported on the top of the mold and to form an annular space with the projecting portion of said feeder member, and having at its upper end a collar portion flaring widely upwardly and outwardly; spring members associated with the interior of the body portion of said sleeve member for engagement with said feeder member to align them axially, and means associated with the feeder member for suspending it from said sleeve member.

ANDREW R. ROWE.