Sept. 27, 1932. W. H. RAMAGE 1,879,485

CLOSED BOTTOM INGOT MOLD

Filed Feb. 28, 1930 2 Sheets-Sheet 1

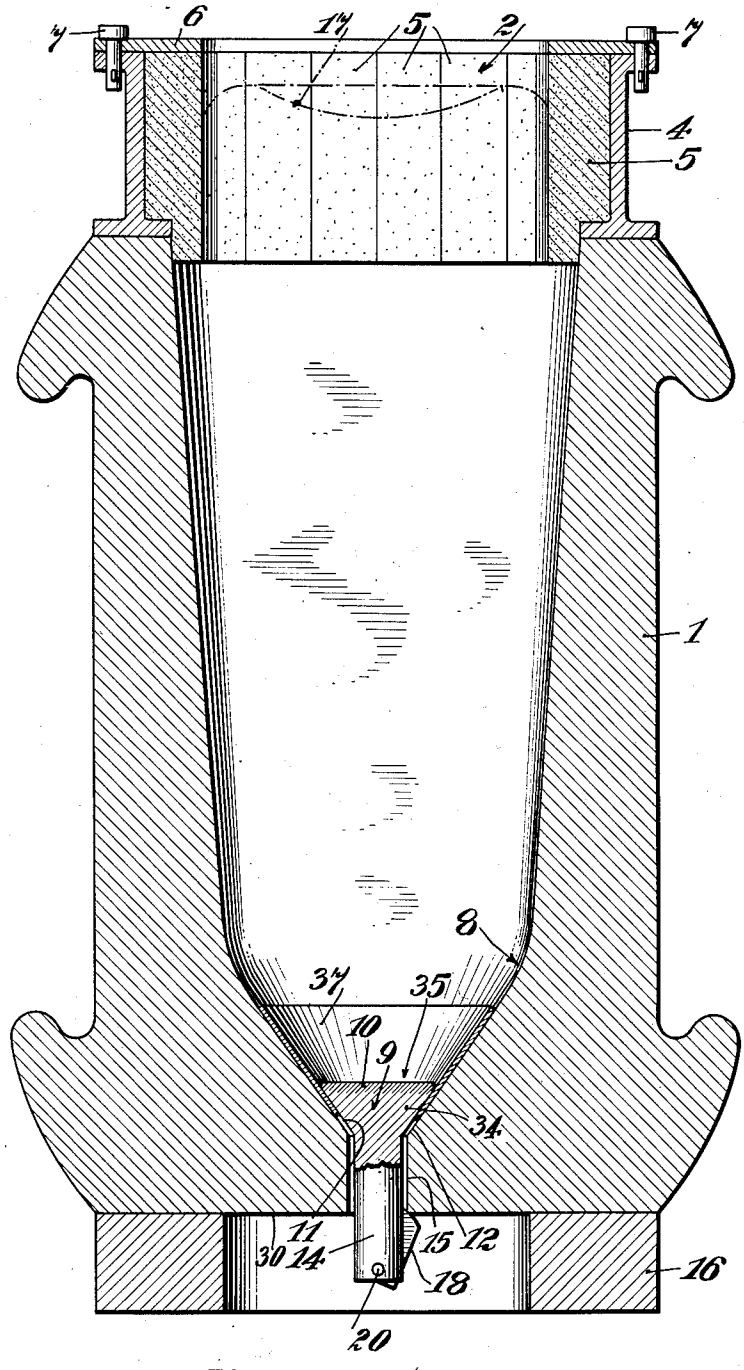


Fig. 1

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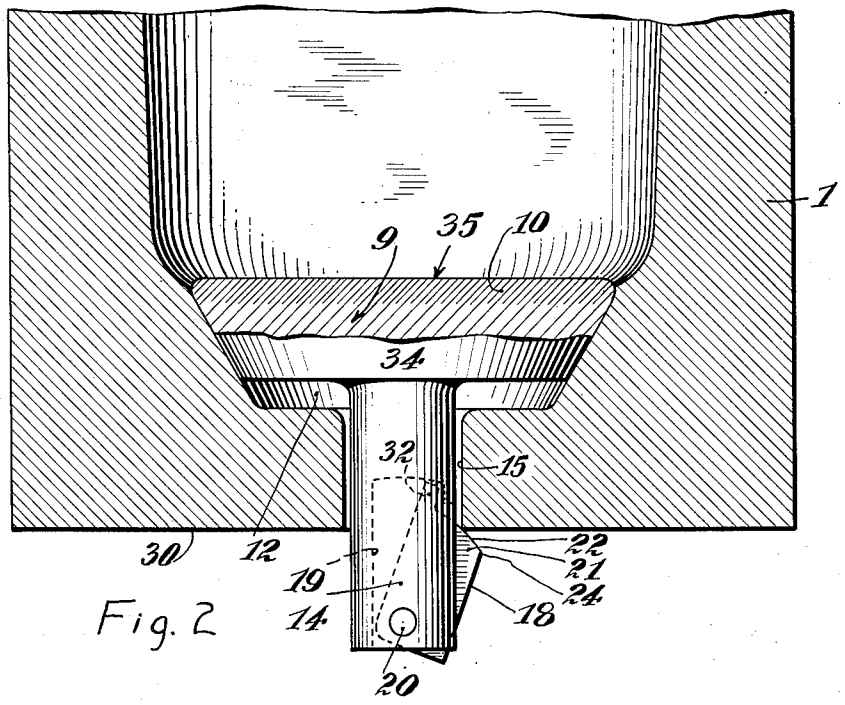


Fig. 2

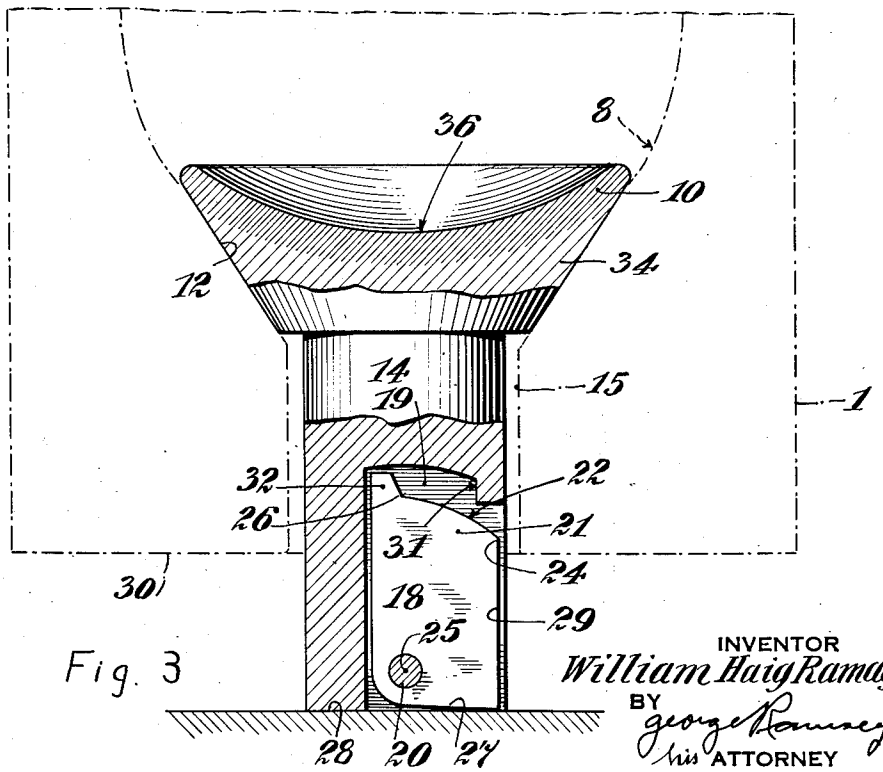


Fig. 3

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UNITED STATES PATENT OFFICE

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CLOSED BOTTOM INGOT MOLD

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The present invention relates broadly to metallurgy and more especially to ingot molds.

The present invention is adapted particularly to the type of molds known in the art as "closed bottom" ingot molds. There are several problems which are peculiar to the type of mold, one of which is the liability of the bottom of the mold being cut by the initial stream of molten steel poured into the mold when ingots are cast therein, and thereby destroying the usefulness of the entire mold. Another problem is to retain the closure plug for the bottom of the mold locked in place until it is desired to remove the plug from the mold. If the plug tends to stick to the lower end of the ingot, and lift from its seat in the mold, when the ingot is being stripped from the mold, in the usual way, scale or other foreign material is liable to drop under and hold up the plug so that at the next cast molten steel will flow in and around the plug and destroy the mold when the ingot is stripped therefrom.

The present invention obviates the above specified difficulties by providing the top of the closure plug with material to which molten steel does not stick or weld and which material does not contaminate the molten steel. Furthermore, according to the present invention, the plug is provided with a lock, preferably automatic in its action, which retains the plug securely and tightly locked in position until it is desirable that the plug be removed.

The present invention also contemplates the use of a liner to cover a portion of the bottom of the mold, which liner is held in place by the closure plug and is adapted to be removed from the mold with each ingot. The liner protects the bottom of the mold during pouring and also forms a seal between the plug and the bottom of the mold.

In accordance with the present invention, the plug may comprise only a small portion of the bottom of the mold or it may be of sufficient size to comprise the major portion of the bottom of the mold, and when the plug is locked in position ingots are adapted to be cast in the mold and stripped therefrom without removing the plug, by grasping the portion of the ingot which normally extends into the hot top after the hot top has been removed and by holding down the mold while the ingot is stripped therefrom. Since the plug is locked in position and the top of the plug is treated with a chromium alloy or other substance which prevents sticking of the ingot to the mold, the ingot strips freely from the mold. Any scale or foreign material dropping into the mold is removed by suitable apparatus such as suction means and the mold is ready for the next cast without further attention. These casting operations continue until either the plug or the mold is so worn as to require displacement, in which case the lock of the plug may be released and the plug removed from the mold.

Other and further objects of the present invention will in part be obvious and will in part be pointed out hereinafter in the following detailed description.

While the present disclosure comprises the preferred form of the invention, it is to be understood that the disclosure herewith is illustrative and not to be considered in the limiting sense.

Fig. 1 illustrates a sectional view through an ingot mold set up in accordance with the present invention.

Fig. 2 illustrates a plug in accordance with the present invention having an enlarged head comprising the major portion of the bottom of the mold matrix.

Fig. 3 is a detailed view showing a portion of the plug in cross section to more clearly illustrate the construction of the preferred form of lock.

Referring now to the drawings and more especially to Fig. 1, which illustrates an ingot mold set-up in accordance with the present invention, the ingot mold 1 is of the type known in the art as the "closed bottom" mold. A hot top 2 is illustrated in position on the mold and comprises an annular metal frame 4 carrying brick liners 5, which are held in place by a top plate 6 that is secured in position by key bolts 7. The bottom of the matrix 8 of the ingot mold is closed by a closure plug 9, the top of which is covered

with material 10 to which molten steel does not tend to weld; the preferred material being a layer 10 of chromium and iron alloy which may be applied by impregnation of the top of the plug at the time the plug is cast or it may comprise a plate of such material cast in position or forced in position on the head of the plug during the manufacture of the plug. Other high melting point alloys such as manganese, tungsten, etc., may be used in the place of chromium alloy, although chromium alloy is the preferred material. The head of the plug preferably comprises an inverted frustum of a cone with side walls 11 constructed to accurately fit corresponding side walls 12 at the bottom of the matrix 8 of the mold 1. The stem 14 of the plug extends through the bottom opening 15 of the ingot mold a sufficient distance so that if the mold is lifted from the stool 16 and set down upon a hard plane surface, the lower end of the plug will contact with the surface and the plug will act as a pusher member helping to expel an ingot which tends to stick in the mold. However, in the majority of cases by removing the hot top and grasping the upper end 17 of the ingot (indicated in dotted lines in Fig. 1) the ingot may be lifted from the mold without removing the mold from the stool 16, and it is desirable that the plug 9 be locked in position to insure that the surface 11 on the side walls of the plug does not tend to leave the surface 12 on the mold.

In view of the fact that the plug 9 is inserted through the mouth of the matrix of the mold and is usually placed in position after the mold is set on the stool, it is desirable to provide a lock which is automatic in its action and to that end, the present invention comprises a pivot lock plate 18 mounted in a recess 19 in the bottom of the plug and carried by a pivot member 20. The upper end 21 of the lock plate 18 is a curved cam surface 22, the corner 24 of which is nearer to the axis 25 of the pivot member 20 than is the upper corner 26. The bottom portion 27 of the lock plate 18 is preferably so located that when the bottom 28 of the plug 9 is rested against a plane solid surface, the lock plate is automatically swung to a position where no part of the plate extends outside of the body of the plug 9, as is illustrated in Fig. 3. In this position, the plug is unlocked and may be pushed through the opening 15 in the bottom of the mold. However, when the plug is dropped in position through the matrix of the mold, the sides of the opening 15 coming in contact with the face 29 of the lock plate swings the lock plate within the recess 19 so that the plug drops freely into position with the stem extending through the opening 15 in the bottom of the mold. As soon as the lock plate passes below the bottom 30 of the mold 1. the weight of the plate 18 being off center relative to the pivot 20, the lock plate drops sidewise until the cam surface 22 contacts with the bottom surface 30 of the mold, thereby securely locking the plug in the mold, as is illustrated in Figs. 1 and 2. Preferably, the recess 19 is provided with a shoulder 31 which is adapted to engage a projection 32 on the lock plate 18 to prevent the lock plate from falling outwardly to an inoperative position when the plug is being lifted to be inserted in the mold.

The head 34 of this plug may be relatively small as compared to the matrix 8 of the mold as is illustrated in Fig. 1 or it may be relatively large as compared with the matrix as is illustrated in Fig. 2. The top of the plug may be a plane surface 35 as shown in Figs. 1 and 2 or it may be a cupped surface 36 as shown in Fig. 3.

From the foregoing, it will be observed that the head 34 of the plug 9 comprises the central bottom portion of the mold, upon which the initial molten stream of steel strikes when the ingot is being poured, and where a cupped surface 36 is provided an initial pool forms in this cup, which prevents cutting of the mold by the initial stream of molten steel, and in view of the character of the metal 10 of the head 34, there is no tendency of the ingot to stick to the plug. In this way, the life of the ingot mold is greatly increased.

It is to be understood that according to the present invention while it is preferred that the head 34 of the plug shall be treated in such manner as to resist the cutting action of the steel, this precaution is not absolutely necessary because if the ordinary materials are used for the plug and the molten steel stream is directed to strike the plug, the cutting action of the initial stream of molten steel is confined to the head of the plug, so that the severe wear of the set-up is confined to this plug member, and if the plug becomes so badly cut and worn as to require replacement, this member is removed and replaced while the remainder of the mold is retained in good condition.

While the side walls 11 of the head of the plug 34 are fitted to the side walls 12 of the plug recess, it is desirable in the use of molds to have a plurality of plugs which may be used interchangeably with a plurality of different molds. Under these conditions, it may be desirable to use a filter material between the head of the plug and the side walls. Where this occurs it is preferable the filler material shall comprise a liner 37 adapted to fit the bottom of the mold matrix as illustrated in Fig. 1. This liner may comprise a member of paper or thin metal sheet or other suitable material. Preferably, the liner 37 extends over the bottom part of the matrix of the mold 1 adapted to be struck by the molten steel stream, during pouring of the steel to

form the ingot, and prevents the molten steel stream from cutting the bottom of the mold. This liner, therefore, performs the double function of protecting the bottom of the mold and forming a seal between the plug and the opening in the bottom of the mold. Furthermore, since the liner 37 extends beneath the head 34 of the plug, the liner is fixedly locked in position.

Having described my invention, I claim:

1. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, and gravity operated locking means carried by said stem portion.

2. An article of manufacture comprising a closure plug for ingot molds, said closure plug having a head portion adapted to close the opening in the bottom of the ingot mold, a stem secured to said head, and pivoted locking means carried by said stem and pivoted to swing outwardly relative to said stem.

3. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, and having locking means pivoted to and permanently carried by the stem portion.

4. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, said stem portion being provided with a recess and a locking member permanently secured within said recess in the stem portion, a part of said member moving outside of the confines of said stem portion for locking the stem in a mold.

5. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, and a locking member pivotally mounted within said stem portion, a part of said member movable to a position outside of the confines of the stem portion when said stem portion is in a vertical position in a mold.

6. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, and a locking member pivotally mounted within said stem portion, a part of the member movable to a position outside of the confines of the stem portion when said stem portion is in a vertical position, and stop means for limiting the movement of said locking member.

7. As an article of manufacture, a closure plug for closed bottom ingot molds, said closure plug having a head portion and a stem portion, and a locking member so pivotally mounted within said stem portion that a part of the member swings outside of the confines of the stem portion when said stem portion is in a vertical position, said locking member having a part extending beneath said stem portion when said first mentioned part is outside of the confines of said stem portion.

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