Aug. 9, 1932. F. B. McKUNE 1,871,333

HOT METAL LADLE

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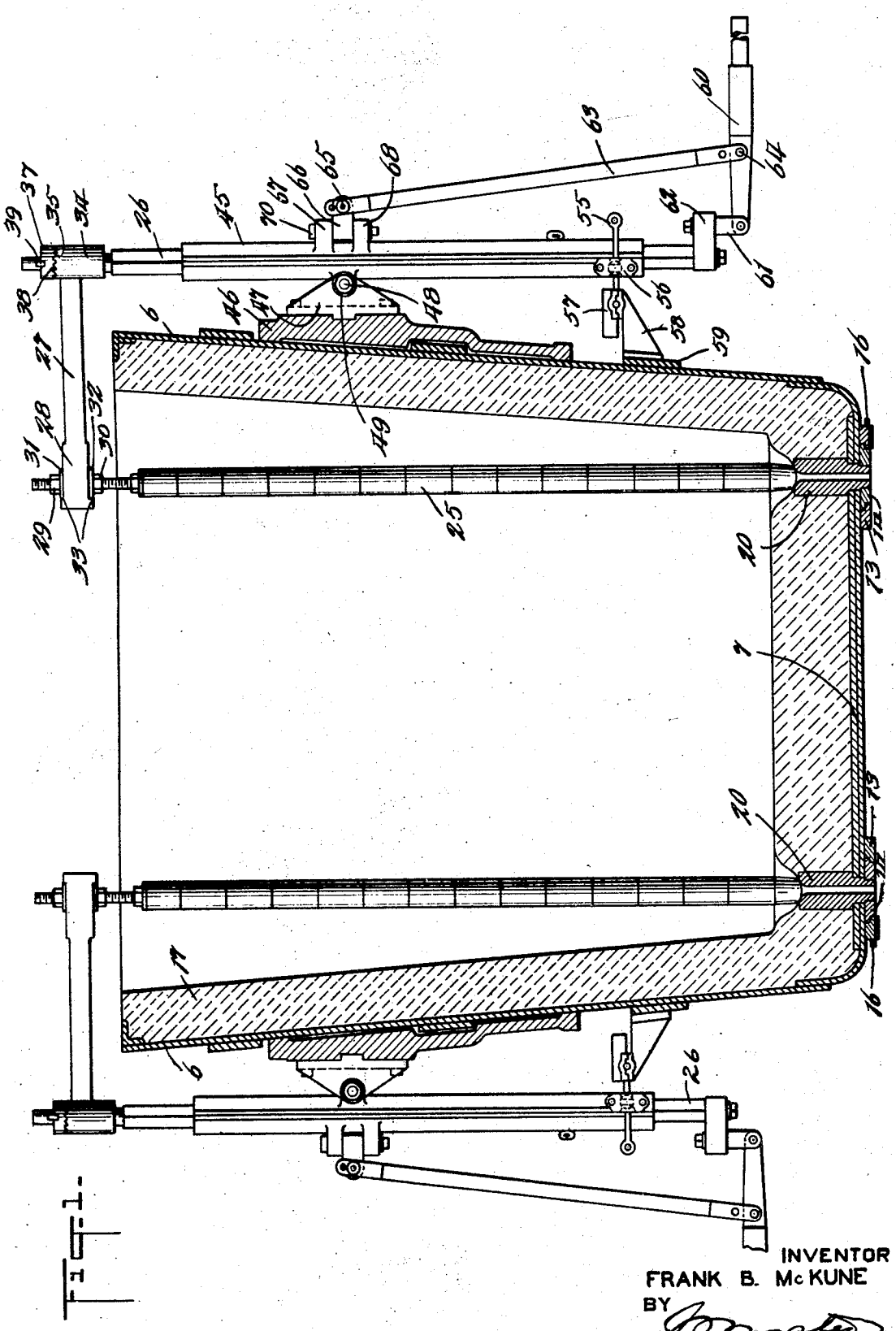


Fig. 1.

INVENTOR
FRANK B. McKUNE
BY
ATTORNEY

Aug. 9, 1932. F. B. McKUNE 1,871,333

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Fig. 2.

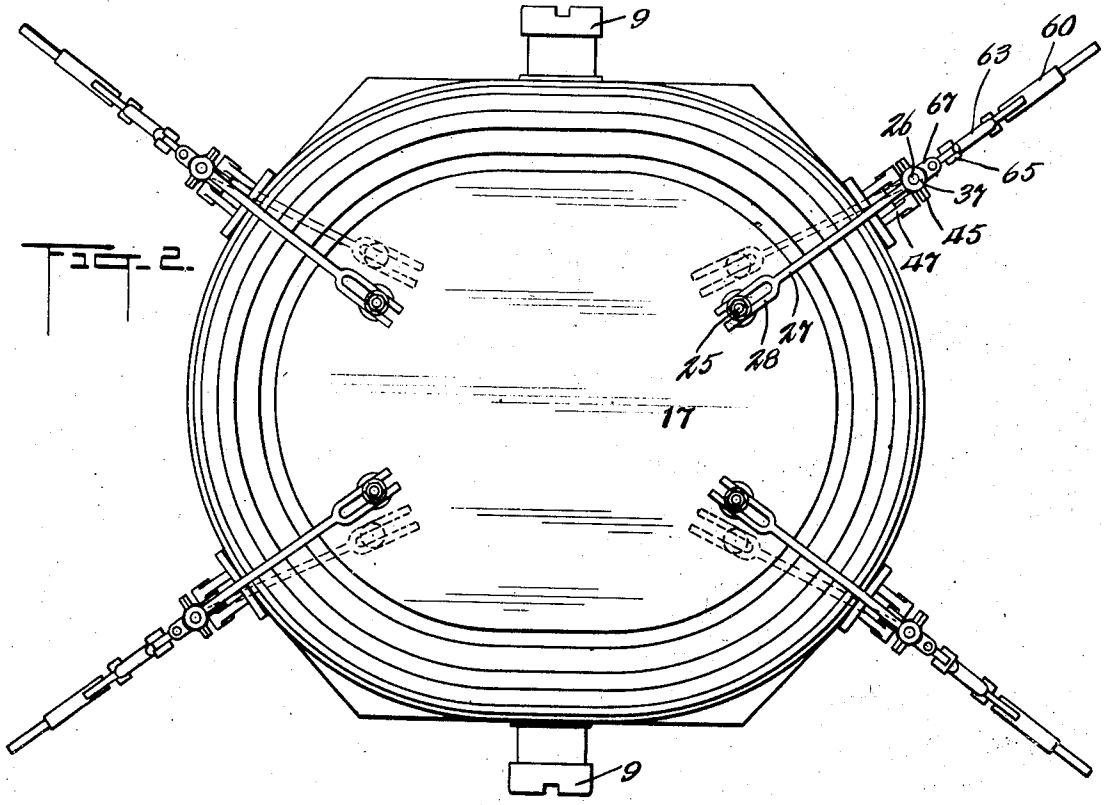
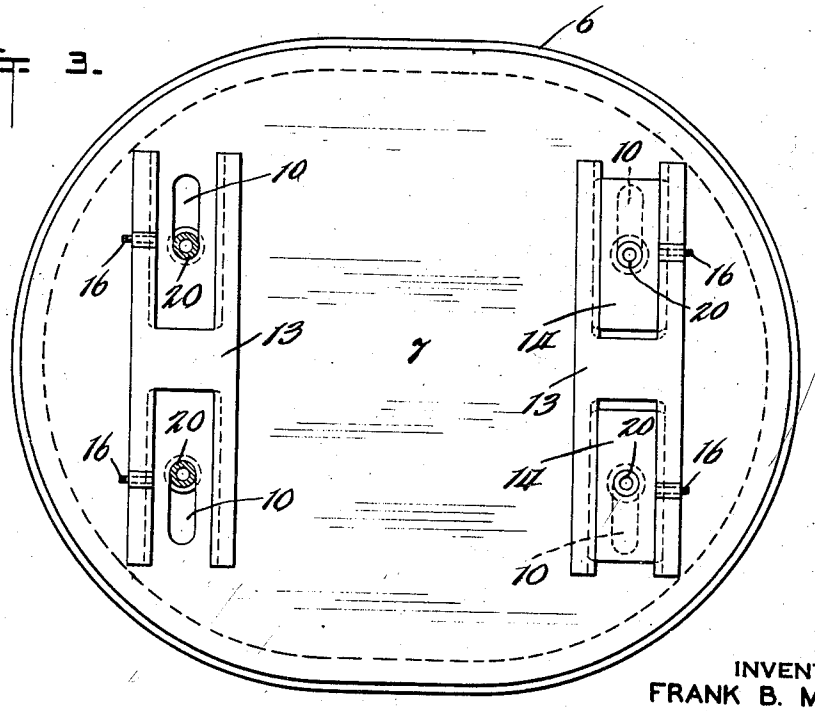


Fig. 3.



INVENTOR
FRANK B. McKUNE
BY
ATTORNEY

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Fig. 4.

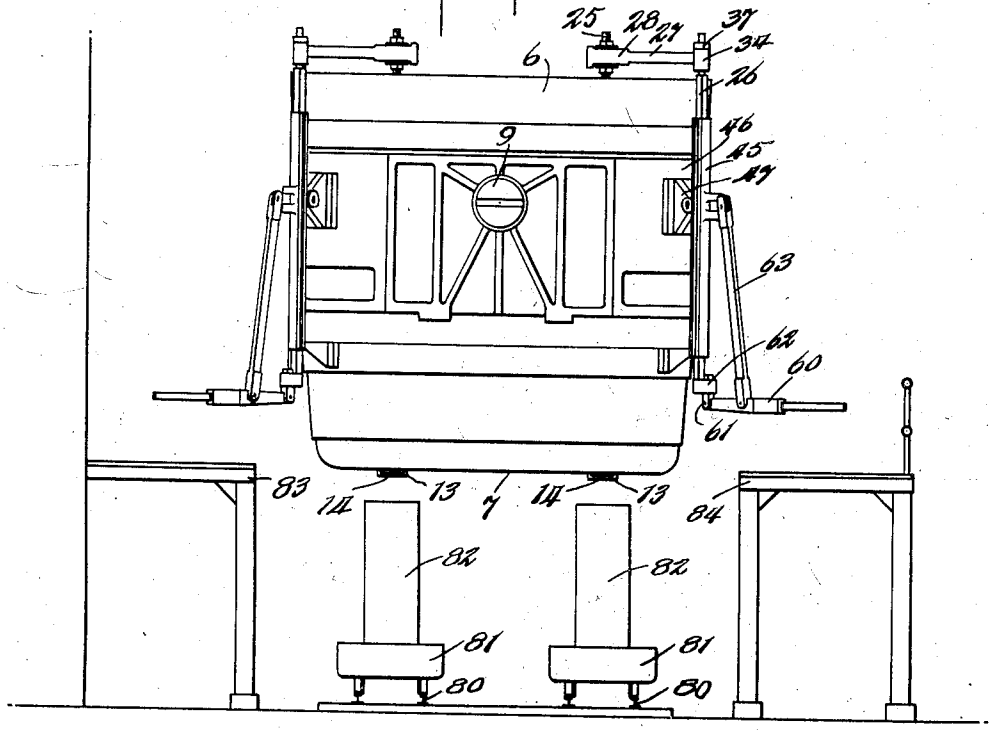


Fig. 5.

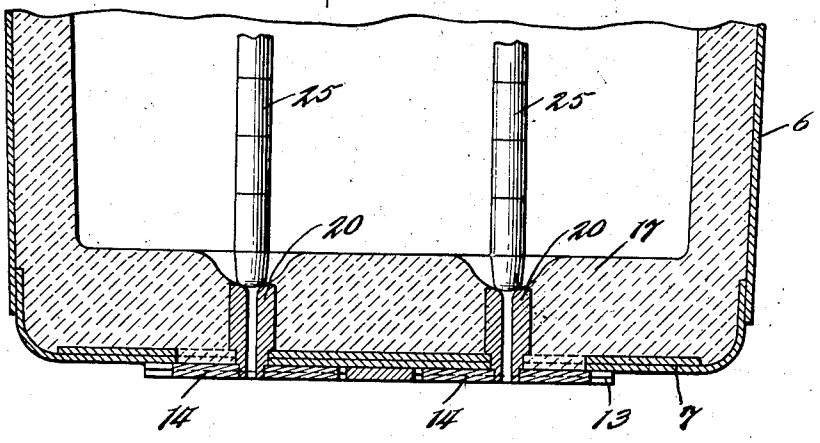
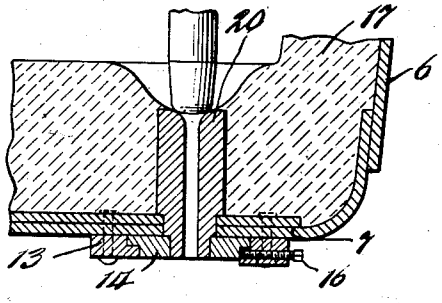


Fig. 8.



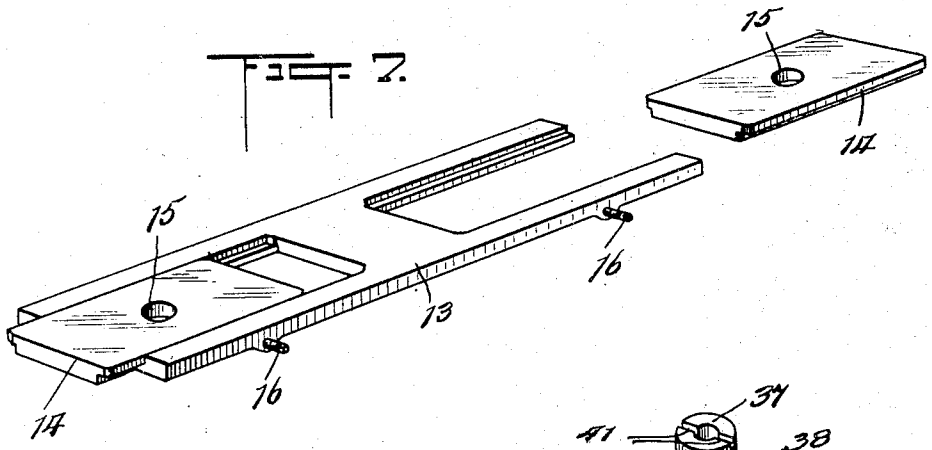
INVENTOR
FRANK B. McKUNE
BY
ATTORNEY

Aug. 9, 1932. F. B. McKUNE 1,871,333

HOT METAL LADLE

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FIG. 7.



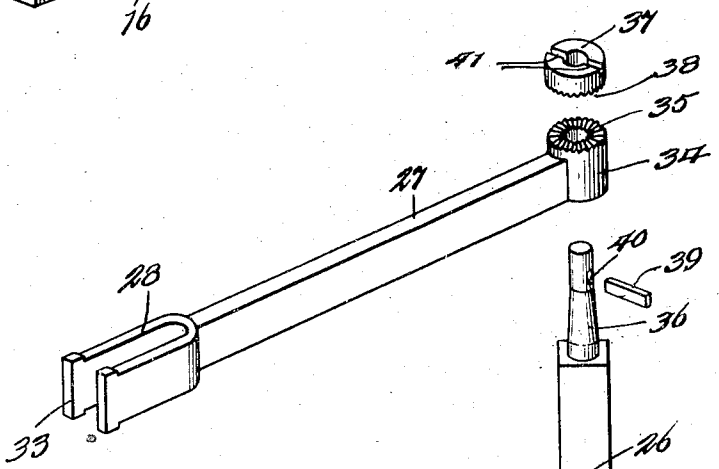


FIG. 8.

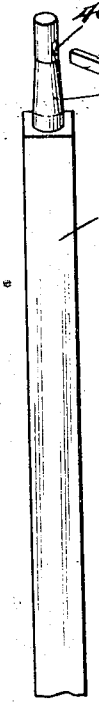
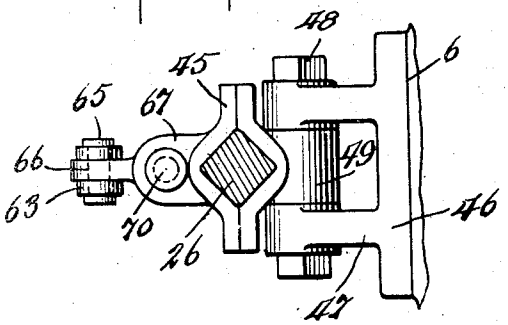


FIG. 9.



INVENTOR
FRANK B. Mc KUNE
BY
ATTORNEY

Patented Aug. 9, 1932 1,871,333

UNITED STATES PATENT OFFICE

FRANK B. McKUNE, OF HAMILTON, ONTARIO, CANADA

HOT METAL LADLE

Application filed November 17, 1930. Serial No. 496,071.

This invention relates to hot metal ladles and, more particularly, to that type of hot metal ladle having a plurality of openings and stoppers in the bottom thereof whereby a plurality of molds disposed on tracks beneath the ladle may be filled substantially simultaneously.

In the production of ingots it is desirable to employ a multiple stopper hot metal ladle for filling several molds simultaneously, so as to avoid excessive cooling of the ladle charge. As it is desirable to deliver the hot metal substantially in the middle of each mold, whenever the mold size or spacing is changed, it becomes necessary to likewise change the spouts and stoppers.

An object of this invention is to provide a ladle wherein the distance between discharge openings and the stopper mechanism may be adjusted to a considerable extent without necessitating a substantial rebuilding of the ladle.

A still further object is to provide a ladle which will accomplish the above objects and yet be of simple practical design with no complicated or fragile parts and adapted to be easily and conveniently operated.

The ladle, according to the present invention, comprises an outside metal shell provided with one or more pairs of slots in the bottom thereof, and movable stopper seat plates carried by the bottom and adapted to be positioned in the slots, whereby shifting of the plates will enable the stopper seats to be spaced as desired. The stopper rigging is also arranged to be adjustable to correspond, so that the work of removing and replacing the bottom lining affected by changing the spouts, can be cheaply and rapidly done.

The stopper mechanism comprises a vertical stopper rod adapted to control the discharge of metal through the stopper seats carried by the movable bottom plates, a vertical slide bar mounted on the outside of the ladle, a horizontal arm mounted on the upper end of the slide bar and pivotally movable about the longitudinal axis of the bar, means for locking the arm against such movement after its position is adjusted, means connecting the arm to the stopper rod to allow limited movement of the rod relatively to the longitudinal axis of the arm, and means for vertically moving the slide bar to operate the stopper rod.

To illustrate the invention more clearly reference is had to the accompanying drawings in which:

Fig. 1 is a vertical longitudinal section of a ladle embodying the invention.

Fig. 2 is a top plan view;

Fig. 3 is a bottom plan view;

Fig. 4 is an end elevation of the ladle showing molds in position to receive the hot metal and the adjacent operator's platforms;

Fig. 5 is a fragmentary vertical section transversely of the bottom of the ladle;

Fig. 6 is a fragmentary detail view of the right-hand discharge outlet shown in Fig. 1;

Fig. 7 is a perspective view in detail of one of the tracks adapted to be attached to the bottom of the ladle and the plates carried thereby;

Fig. 8 is separated perspective view of the slide bar and associated parts; and

Fig. 9 is a detail horizontal view of the slide bar mechanism with the slide bar shown in section.

The ladle comprises a metal shell having sides 6 and bottom 7. The sides 6 have trunnions 9 to receive the lifting chain from a crane whereby the ladle is supported and transported. The bottom 7 is provided with pairs of slots 10 (two pairs being illustrated in the drawings), the longitudinal axes of the two slots of each pair being in alinement with each other, and associated with each pair of slots is a track member 13 (shown in detail in Fig. 7) extending parallel to and along each side of the slots and bolted to the outside of the bottom 7 of the shell. The ends of each track member 13 are open and adapted to receive the sliding stopper seat plates 14, each of which is provided with an orifice 15 adapted to be registered with the adjacent slot 10 in the bottom 7. Set screws 16 are carried by the track members 13 to hold the plates 14 in position once the distance between the orifices 15 has been determined.

The metal shell is lined with refractory brick 17 but openings are left therein op-

posite the orifices in the plates 14 and stopper seats 20 of refractory material are disposed in said openings. As shown in Fig. 6, the slot 10 is of greater width than the diameter of the orifice 15 in the plate 14 and the seat 20 is provided with a flange which abuts against the plate 14 and a second flange of greater diameter which bears against the bottom 7 of the ladle. This construction allows the seats 20 to be securely held in place and also, due to the intermediate reduction between its large upper portion and small lower end, tends to prevent fracture due to unequal expansion from heat.

As the plates 14 are slidable in their track member 13, the distance between orifices 15 may be adjusted in any desired position as long as the orifices register with their adjacent slots 10. Once the position of the plates 14 is established, they are anchored in position by means of set screws 16 and the seats 20 inserted and then the refractory brick 17 built up around the seats 20. When it is desired to change the distance between the outlet orifices, the refractory brick 17 around the seats is ripped out, the plates 14 adjusted and the refractory brick replaced.

The flow of metal through each of the discharge openings in the bottom of the ladle is controlled by an individual vertical stopper rod 25 the top part of which is threaded and the rest of which is protected by refractory material. This rod 25 is connected to the vertical slide bar 26 by means of the horizontal arm 27 which is bifurcated to form a fork 28 which embraces the stopper rod 25 adjacent its upper end. Nuts 29 and 30, respectively, and washers 31 and 32, respectively, are disposed on the threaded part of rod 25 above and below the fork 28, the ends of said fork being widened at 33 to prevent the arm 27 from becoming disconnected from rod 25. This construction allows limited movement of the rod 25 along the longitudinal axis of the arm 27.

The arm 27 at its other end is formed into a collar 34 provided with teeth 35 on its upper surface and the collar 34 fits on the upper part of slide bar 26 which is round and tapered at 36, the opening in the collar 34 being correspondingly tapered. The arm 27 is thus free to rotate about the longitudinal axis of slide bar 26. To lock arm 27 against such movement the lock washer 37 is placed on the slide bar 26 above the collar 34, said washer being provided with teeth 38 to engage the teeth 35 on collar 34 and prevent relative movement between the washer 37 and arm 27. The washer is locked on slide bar 26 by means of key 39 passing through slot 40 in the slide bar 26 and grooves 41 in the upper surface of the washer.

The slide bar 26, which is of angular cross section except for its upper portion, is slidably mounted in the sleeve 45, also of angular cross section. This sleeve is pivotally attached to the side 6 of the shell by means of the band 46 encircling the shell and carrying the bracket 47 which receives a bolt 48 passed through an ear 49 mounted on the sleeve 45 (see Fig. 9). To keep the sleeve 45 in vertical position an adjusting screw 55 is passed through an ear 56 provided with an interiorly threaded opening, and into the clamp 57 carried by bracket 58 mounted on band 59 encircling the ladle.

The slide bar 26 is moved vertically by the operator to seat and unseat the stopper rod 25 by means of the lever 60 which is pivotally connected to the forked link 61 carried by the block 62 bolted to the lower end of the slide bar 26. The fulcrum for the lever 60 is provided by the link 63 bifurcated at both ends and carrying pin 64 at its lower end which is passed through lever 60. The link 63 is pivotally connected at its upper end to the sleeve 45 by means of pin 65 passing through the ear 66 connected to ears 67 and 68 mounted on sleeve 45 by pin 70.

From the above description it will be seen that the stopper mechanism can be readily adjusted when the position of the discharge openings is changed. The arm 27 can be moved about the longitudinal axis of the slide bar 26 merely by removing the key 39 and the stopper rod 25 can move to a limited extent along the longitudinal axis of the arm 27; such movement is sufficient to aline the stopper rod with its adjacent discharge opening regardless of the position of that opening with respect to its associated slot 10 as is shown in Fig. 2, stopper rod 25 being shown in full lines in one position and in dotted lines in another position in this figure.

Fig. 4 shows the usual arrangement of the ladle disposed above a pair of parallel tracks 80 on which are cars 81 carrying molds 82. Platforms 83 and 84 are usually provided for the operator who can easily control the flow of metal through any discharge opening by manipulation of its control lever 60 from the platform.

In addition to the many advantages noted above, it will be evident that my improved ladle makes it possible to dispose of the metal faster than heretofore when it reaches a critical casting temperature. This enables the heat to be cast at much closer temperatures and held in the ladle longer than heretofore, giving the impurities a better chance to work to the surface.

The invention claimed is:

1. A multiple stopper ladle having a bottom provided with a plurality of discharge openings, means for varying the distance between said openings, movable stoppers for said openings, external actuating means for the stoppers, and means for adjusting the

stoppers to cooperate with the discharge openings.

2. A multiple stopper ladle comprising a bottom having a plurality of openings, apertured plates movable to close said openings and vary the spacing of said apertures, fastening means for said apertured plates, stoppers for said apertures, externally controlled operating means for said stoppers, and means for adjusting said stoppers relatively to the actuating means to cooperate with said apertures in a plurality of positions.

3. A stopper ladle comprising a body provided with a pair of slots in the bottom thereof, a track member carried outside the bottom of said body extending parallel to said slots, movable plates carried by said track member and provided with discharge openings adapted to be registered with said slots, stopper seats disposed in said discharge openings and extending through the slots in the bottom of the ladle, and means for controlling the discharge of metal through said stopper seats.

4. A stopper ladle comprising a body provided with a pair of slots in the bottom thereof, the longitudinal axes of said slots being alined, a track member carried outside the bottom of said body extending parallel to and on both sides of said slots, sliding plates carried by said track member and provided with discharge openings adapted to be registered with said slots, means for locking said plates in position, stopper seats disposed in said discharge openings and extending through the slots in the bottom of the label, and means for controlling the discharge of metal through said stopper seats.

5. A stopper ladle comprising a body provided with a pair of slots in the bottom thereof, the longitudinal axes of said slots being alined, a track member carried outside the bottom of said shell extending parallel to and on both sides of said slots, movable plates carried by said track member and provided with discharge openings adapted to be registered with said slots, means for locking said plates in position, a refractory lining in said shell provided with openings opposite the discharge openings in said plates, stopper seats disposed in the discharge openings in said plates and extending through the slots in the bottom of the ladle, and means for controlling the discharge of metal through said stopper seats.

6. A stopper ladle comprising a body provided with a pair of slots in the bottom thereof, a track member carried outside the bottom of said shell, movable plates carried by said track member and provided with discharge openings adapted to be positioned in said slots, means for locking said plates in position, a refractory lining in said shell provided with openings opposite the discharge openings in said plates, stopper seats disposed in the discharge openings, in said plates and extending through the slots in the bottom of the ladle, and means for controlling the discharge of metal through said stopper seats.

7. A stopper ladle comprising a shell provided with a pair of slots in the bottom thereof, a track member carried outside the bottom of said shell, movable plates carried by said track member and provided with discharge orifices adapted to be positioned in said slots and whose diameter is less than the width of said slots, means for locking said plates in position, a refractory lining in said shell provided with openings opposite the discharge orifices in said plates, stopper seats in said openings in the lining extending through said slots and the orifices in said plates, each of said seats having a flange adapted to abut against the plate and a second flange of greater diameter adapted to abut against the bottom of the shell and stoppers for controlling the discharge of metal through said seats.

8. In a hot metal ladle, a stopper seat forming a discharge opening in the bottom of the ladle, means for moving said stopper seat to vary the position of the discharge opening, a vertical stopper adapted to control the discharge of metal through said opening, a vertically movable bar mounted on the outside of the ladle, a horizontal arm mounted on the upper end of said bar, said arm being bifurcated at its opposite end and embracing the stopper to prevent vertical movement of the arm relative to said stopper while allowing horizontal movement of said stopper rod to aline with the discharge opening, and means for moving said bar vertically.

9. In a stopper ladle, a stopper seat forming a discharge opening in the bottom of the ladle, means for moving said stopper seat to vary the position of the discharge opening, a vertical stopper adapted to control the discharge of metal through said opening, a vertically movable slide bar mounted on the outside of the ladle and fixed against rotation about its longitudinal axis, a horizontal arm formed at one end into a collar fitting on said slide bar and adapted to be swung about the horizontal axis of said bar, a lock washer mounted on the slide bar cooperating with the collar part of said arm, the adjacent surfaces of the collar and washer being toothed to prevent relative rotation between said arm and washer when locked, means for locking said washer and collar, means connecting the opposite end of said arm and the stopper to allow limited movement of said stopper to aline with the discharge opening, and means for moving said slide bar vertically.

10. In a hot metal ladle, a stopper seat forming a discharge opening in the bottom of the ladle, means for moving said stopper

seat to vary the position of the discharge opening, a vertical stopper adapted to control the discharge of metal through said opening, a sleeve pivotally connected at its upper end to the outside of said ladle, means connecting the lower end of said sleeve and the ladle to hold the sleeve in vertical position, a slide bar disposed in said sleeve, said slide bar being movable vertically but prevented from rotation about its longitudinal axis, a horizontal arm mounted on the upper end of said slide bar and adjustable about the longitudinal axis of said slide bar, means for locking said arm on said slide bar to form a rigid connection therewith, means slidably connecting said arm and said stopper to aline the stopper with the discharge opening, and means for moving said slide bar vertically.

11. In a stopper ladle, a bottom wall having a slot, a stopper seat communicating with said slot to provide a discharge opening, means for moving said stopper seat along said slot to vary the position of said discharge opening, a vertical stopper controlling the discharge of metal through said opening, a horizontal arm supporting said stopper, means for raising and lowering said arm to move the stopper in a vertical direction, means for rotating said arm to move the stopper in a horizontal direction, and means for moving said stopper lengthwise of said arm to facilitate alinement with said discharge opening.

Signed at Hamilton in the county of Wentworth and province of Ontario, Canada, this seventh day of November, A. D. 1930.

FRANK B. McKUNE.