

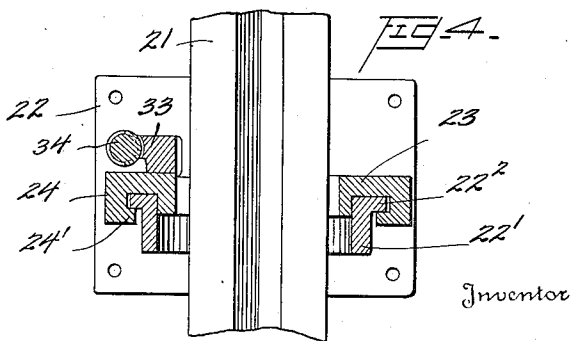
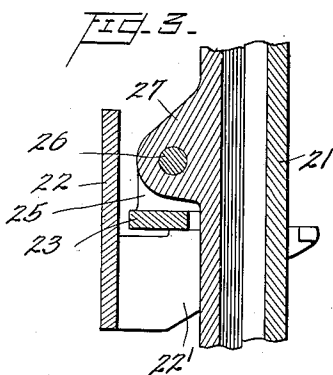
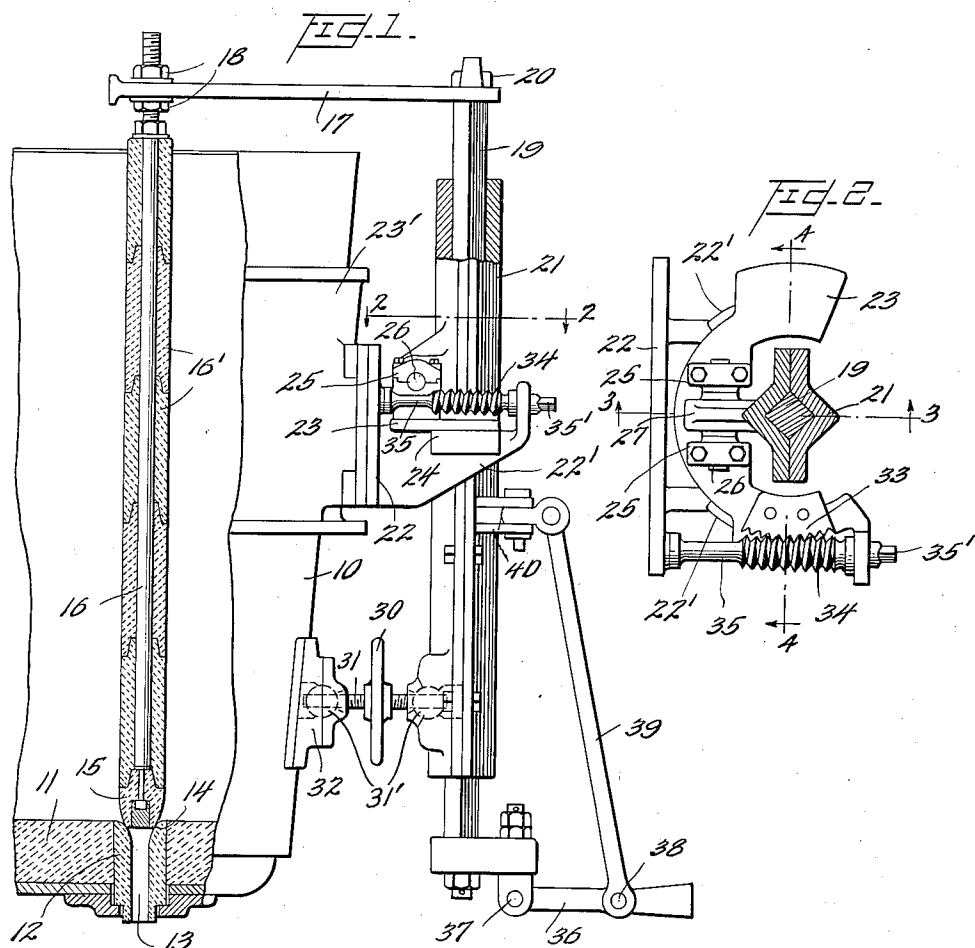
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LADLE

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LADLE

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The present invention relates to ladles of the open type such as are commonly used in and around steel plants for the transportation of molten materials, and particularly to stopper rigs for such ladles.

The type of ladle with which the improved stopper rig contemplated by the present invention is particularly useful embodies a port in the bottom thereof through which the molten contents of the ladle may be discharged. The improved stopper rig comprises, in addition to a stopper for controlling the flow of molten material through this discharge port, stopper operating mechanism the major portions of which are located without the ladle and are there provided with manually operable means for manipulating the stopper for the purpose of controlling the flow of molten material, and, in addition, includes devices for effecting precise adjustment of the stopper relatively to that surface of the discharge port or nozzle which comprises the stopper seat when the stopper is in port closing position. The desirability of using stopper manipulating mechanism which has the capacity for adjustment from time to time is obvious, it being highly desirable to prevent leakage of molten material around the stopper at all times, and the high temperatures to which the ladle and the stopper rigging are subjected being likely to cause distortion of the stopper supporting and manipulating means. In accordance with the present invention a simple, rugged and durable stopper rig is provided which nevertheless permits all necessary manipulation and adjustment of the stopper to be readily effected.

One form of the invention is illustrated in the accompanying drawing, in which:

Figure 1 is an illustration of portion of a ladle, having attached thereto the novel and improved stopper rig;

Figure 2 is a section on line 2—2 of Figure 1;

Figure 3 is a section on line 3—3 of Figure 2; and

Figure 4 is a section on line 4—4 of Figure 2.

The ladle shell is indicated at 10 and the refractory lining at 11. At the bottom of the ladle both shell and lining are apertured for the reception of a tubular plug 12, the central port 13 of which comprises the discharge port for molten materials, this duct or port flaring upwardly at its upper end to provide a seating surface 14 for a stopper. The stopper, which is indicated at 15, is fabricated of refractory material and is shaped in such manner that, when positioned as

shown in Figure 1, it comprises a complete closure for the discharge port 13.

Stopper 15 is secured to the lower end of stopper rod 16, which is of metal and protected by a series of cylindrical refractory sleeves 16' at all points along its length which are likely to come into contact with molten material. Rod 16 is suspended at its upper end from an arm or crossbar 17 extending over the upper edge of the ladle, the securing means preferably including locking nuts 18, one positioned above and one positioned below the crossbar 17 and both having threaded engagement with the upper end of rod 16 in order that vertical adjustment of rod 16 relatively to crossbar 17 may be effected if desired. At its opposite end the crossbar 17 is rigidly secured to the upper end of a rod 19, by means of a key 20, the rod 19 being disposed in a generally vertical direction and extending through, and slidably fitting within, a longitudinally apertured guide member or barrel 21. Rod 19 is of non-circular cross-section and the recess in guide 21 is of similar cross-section, as most clearly seen in Figure 2, so that angular movement of the guide 21 in a horizontal plane will necessarily effect the same angular movement in rod 19 and hence angular movement of crossbar 17 and swinging of the stopper rod 16 and stopper 15 along an arcuate path for the purpose of adjustment.

The guide 21 is in turn supported upon a bracket 22 which bracket is secured to and projects laterally from the ladle shell or a spreader or band 23' which may encircle the ladle shell. Bracket 22 includes two opposed arcuate sections 22' which comprise supporting guides for an arcuate slide 23, formed in one piece and bridging the space between the bracket portions 22'. Slide 23 is provided along its diametrically opposed edges with arcuate downwardly extending flanges 24, portions 24' of which extend inwardly and under the outwardly extending arcuate flanges 22' of the spaced bracket portions 22'. The slide 23 is therefore locked to the bracket against movement axially of the guide 21, but may slide upon the arcuate portions 22' of the bracket in a plane which is generally transverse to the axis of the ladle.

Spaced bearings mounted upon and rigid with slide 23 are indicated at 25 and a short shaft 26 is shown to have its ends supported in these bearings. This shaft is engaged intermediate bearings 25 by an arm 27 of guide 21, the guide being, by the means just described, mounted upon the slide 23, but in such manner that its posi-

tion may be angularly adjusted in a vertical plane about the axis of the transversely extending shaft 26. For effecting such angular adjustment hand wheel 30 is provided, this hand wheel being rigidly fixed upon shaft 31, the opposite ends of which are threaded in reverse directions and have threaded engagement with the lower end of the guide 21 and a member 32 secured to the ladle shell, respectively. In order to permit free play at this connection to accommodate the described tilting and rotating movements of the rig, the threaded engagement at both ends of the shaft 31 are preferably effected through the intermediary of an extensible and rotatable universal ball joint as indicated at 32' in Figure 1.

Fixed upon the upper surface of slide 23 is a toothed segment 33, the teeth of which are in mesh with the thread of a worm 34 formed upon a horizontally extending shaft 35 the ends of which are supported by the bracket. Rotation of worm 34 by the manipulation of a manually operable tool applied to the square end 35' of shaft 35 effects movement of the slide 23 upon the supporting bracket in a plane substantially normal to the ladle axis and it is hence by means of the worm 34 that the stopper 15 may be moved in an arcuate path about a center which is without the ladle.

The rod 19 is moved vertically in the guide 21, for the purpose of raising or lowering the stopper by means of a manually operable lever 36 pivotally connected at 37 to the lower end of rod 19 and fulcrumed at 38, the pivot 38 being supported by means of a diagonal suspending link or rod 39 the upper end of which is attached to a bracket 40 integral with the guide 21. It will be perceived that the guide is formed in two portions, secured together by bolts or other suitable means, that portion remote from the ladle being readily removable without dislodgement of the portion secured to the slide 23, for the purpose of replacement of rod 19 should it become warped.

By means of the rig illustrated, the stopper 15 may not only be readily raised and lowered by an operator positioned without the ladle, but may be readily adjusted in position with respect to the seating surface 14, by manipulation of the adjusting worm 34, which may likewise be conveniently rotated. The arcuate slide 23 is rigidly supported by the bracket 22 but may be readily moved thereon for the purpose of revolving the guide 21, rod 19 and crossbar 17. Slide 23 is locked in any position to which it may be adjusted by the worm 34. It will be perceived that the rod 19 is disposed substantially axially of the arcuate slide supporting portions 22' of the bracket 22 and that the arcuate slide 23 partially encircles the guide and is approximately concentric with the vertical axis of rod 19. The

weight of the stopper, bar 17, rod 19, guide 21 and other parts is transmitted to slide 23 midway between the bracket arms 22' and the arrangement has the advantage of compactness as well as that of great strength and ruggedness.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. A combination with a ladle having a stopper-controlled discharge opening therein, of a bracket secured to said ladle and having a partly circular guiding portion thereon, and a stopper rig carried by the bracket and supporting a stopper for application to and removal from the opening in said ladle, said stopper rig comprising a partly circular member mounted upon the similarly formed guiding portion of the bracket for rotative movement about an axis generally parallel to the ladle axis, an elongated stopper supporting rod extending substantially parallel to the ladle axis, and means mounting said rod on said member for tilting movement about an axis which is transverse to said rod, said guiding portion of the bracket and said member both being open laterally to provide an aperture for the lateral insertion and removal of said rod.

2. The combination with a ladle having a stopper-controlled discharge opening, of a bracket secured to the exterior side wall of said ladle and provided with a guiding portion thereon having the form of an arc of a circle and disposed in a plane substantially perpendicular to the axis of the ladle, and a stopper rig carried by the bracket and supporting a stopper for application to and removal from the opening in said ladle, said stopper rig comprising a member also having the form of a circular arc, said member being mounted upon said arcuate guiding portion of the supporting bracket for rotative movement thereon about an axis generally parallel to the axis of the ladle, an elongated stopper supporting rod extending substantially parallel to the ladle axis, the axis of said rod substantially coinciding with the center of curvature of said member and guiding portion, an elongated rod guide embracing and supporting said rod for longitudinal non-rotative adjustment therein, a pintle on said member extending transversely to the axis of said rod, said rod guide being pivotally supported by means of said pintle for tilting movement in a substantially vertical plane, said center of curvature of the member and of the guiding portion of said bracket being on the side thereof which is remote from said ladle, whereby said member and guiding portion open outwardly from the ladle so that said rod and its guide may be removed laterally therefrom.

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