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EMERGENCY STOPPER FOR LADLE POUR HOLES

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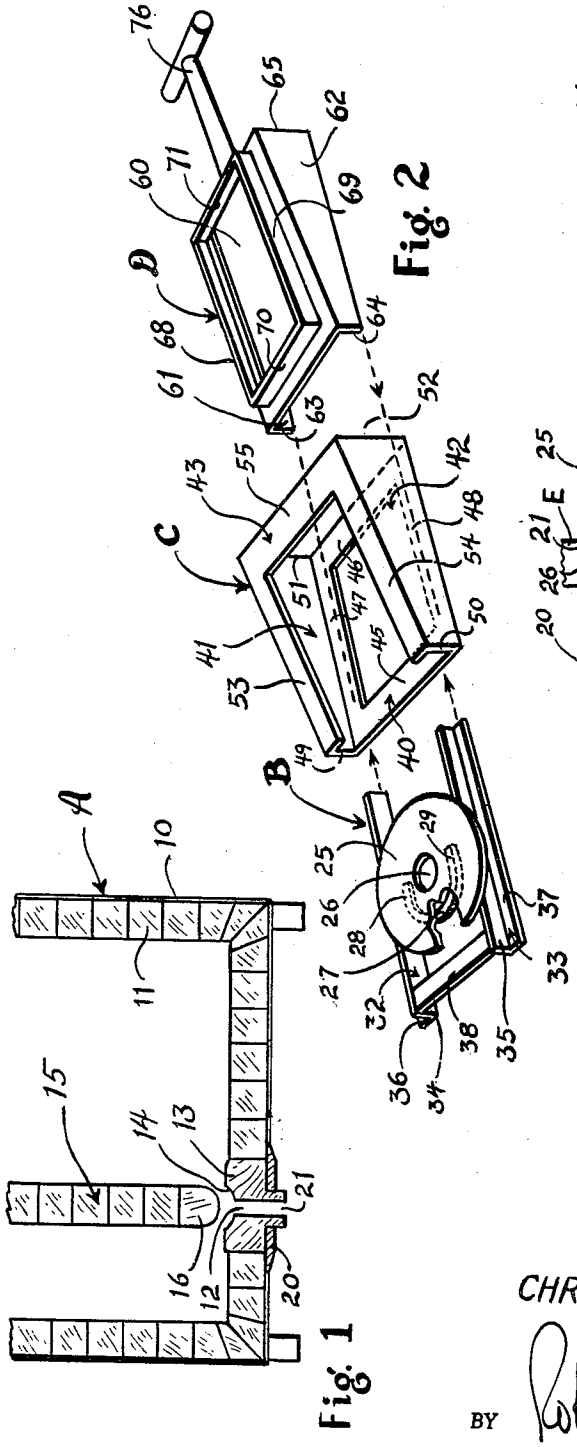


Fig. 1

Fig. 2

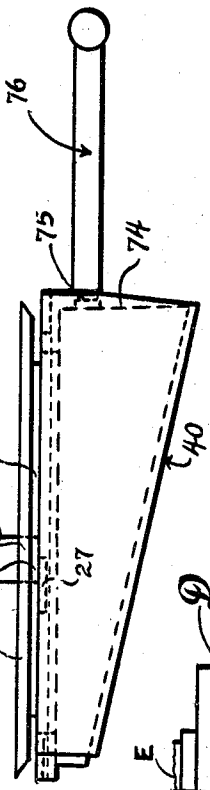


Fig. 4

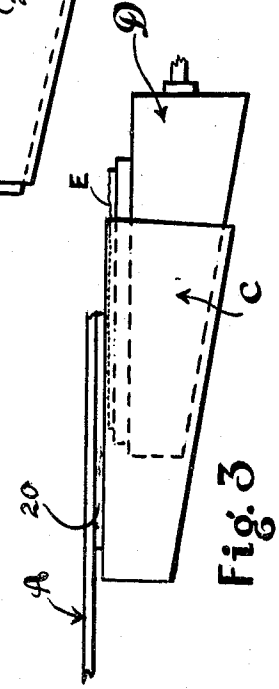


Fig. 3

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EMERGENCY STOPPER FOR LADLE POUR HOLES

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5 Claims. (Cl. 22—85)

This invention relates to an improved structure and method for providing an emergency stopper in pour holes to prevent the spillage of materials from a ladle and the like when the regular stopper becomes defective and is inoperative. More particularly, the invention provides an improved structural arrangement, as an auxiliary attachment, and the method of forcing a plastic aperture closing material into the pour holes of steel ladles and the like when the stopper rod therein becomes defective and fails to properly close the pour hole with molten metal remaining in the ladle and preventing its resultant spillage therefrom without freezing or solidifying metal in the pour hole.

In the present practice of utilizing refractory lined ladles with a stopper rod covered with refractory material, the ever present and feared failure of the stopper rod to close the pour hole, with molten metal in the ladle, is a condition which exists in metal melting plants known to applicant and others. Occasionally the stopper rod fails to operate properly and when this happens with molten metal in the ladle, the spillage of the molten metal causes considerable damage and injury to materials and personnel which may come into contact therewith. Such accidental spillage and the fear thereof, with a desire for a stopper which would operate effectively, in an easy and efficient manner, are well known to the workers in this field.

Accordingly, it is an object of this invention to provide an improved and simple to operate emergency stopper for forcing a plastic closure material into the pour holes of ladles for molten metals.

It is a further object of this invention to provide an improved emergency stopper for pour holes including an auxiliary frame arrangement attachable about the outlet end of a pour hole, a retainer for plastic material mounted by said frame adjacent the pour hole and cam surfaces on said frame for forcing the plastic material into the pour hole upon the application of pressure against the retainer for the plastic material.

It is a further object of this invention to provide an improved method of inserting and supporting a plastic material in pour holes for molten metal, upon the instant application of pressure to a body of plastic material held in readiness in close proximity to the outflow of a molten metal which cannot be stopped by the normal operation of a stopper rod.

Further objects, advantages, and application of the structural arrangement herein provided will be apparent from the following description of the accompanying drawings, wherein;

Figure 1 is a partial cross sectional view of a standard ladle illustrating an outlet, or pour hole, in relationship to a stopper rod therefore.

Figure 2 is an exploded view illustrating the structural components in a relative ready to assemble relationship.

Figure 3 is a diametric plan view of the component structures shown in Figure 2 in a ready to operate relationship relative to the ladle shown in Figure 1.

Figure 4 is a side plan view of the component structures

shown in Figure 2 in operative relationship relative to the structure shown in Figure 1.

With reference to the drawings, like parts will be similarly indicated.

There is shown in Figure 1, a conventional ladle A for melting metals. The ladle A is provided with an outside casing 10 having the usual refractory lining 11. In the bottom of the ladle there is also provided the usual pour hole 12. This pour hole 12 is an outlet aperture extending through a conventional refractory slab 13 having a saucer like depression serving as a stopper seat 14 centered about the hole 12 and into which a conventional stopper rod 15 normally seats to close the pour hole 12, to stop any undesired outpouring of molten metal from the ladle. However, oftentimes the mechanism (not shown) which operates the stopper rod 15 and its rod end 16 or the rod seat becomes damaged and the stopper rod 15 and its rod end 16 fail to properly close the pour hole 12. When the pour hole 12 is not closed properly, with liquid metal in the ladle A, the liquid metal oftentimes overruns the pit or catch basin and spills out over the floor under the ladle. This spillage solidifies over and about any object which lies in its path and causes much damage.

Usually there is a heat resistant washer like metal plate 20 cemented or suitably secured to the refractory slab 13 and casing 10, on the outlet side of the pour hole. An aperture 21, in the plate 20, is aligned with aperture 12, through which liquid metal from ladle 10 will flow.

To provide for an insert of plastic against the flow of metal from apertures 12 and 21, I have provided a structure of component parts as shown in Figure 2, to be secured to plate 20 in an operational relationship, as shown in Figures 3 and 4. The exploded view of Figure 2, in conjunction with Figures 3 and 4, outlines the detail of structure and its attachment to plate 20, in a cooperational relationship of the component parts, as hereinafter described.

In the embodiment disclosed there is provided a washer plate 25 which is spot welded to plate 20. An aperture 26, in plate 25, is centered under aperture 21 and in alignment with pour hole 12. Under the washer plate 25 and in close proximity to aperture 26 there is spot welded, or otherwise suitably secured, a relatively semi-circular ring or U-shaped flange 27 having its ends 28 and 29 and connecting base partially encircling the aperture 26 about its forward half portion relative to the arrangement of the component parts, as hereinafter set forth. The flange 27 serves as a wall or abutment against which the body of plastic stopper putty or clay is pushed and forced into the pour hole 12 by the component parts shown in Figure 2, when it is desired to stop the outflow of liquid metal therefrom in the event of failure of stop rod end 16 to close off the outflow of liquid metal.

In order to apply a sufficient pressure on the plastic material which must be forced through the apertrue 26 and aperture 21 into pour hole 12, against the weight of the corresponding column of molten metal, I have spot welded or otherwise secured to the underside of plate 25, a trackway structure B. This trackway is formed by a pair of angle irons 32 and 33 serving as guides for carrying a cam frame C, within which the carrier platform D is adapted to normally rest riding in readiness for use, in the manner as shown in Figure 3 and hereinafter described. The relative positioning and cooperational relationship of the component parts B, C and D will be recognized from the following description.

The angle irons 32 and 33 have upstanding flange portions 34 and 35, the uppermost edges of which are spot welded to the plate 25, as indicated, and right angularly turned flange portions, respectively, which serve as carrier trackways for the frame C. A crossbar 38 has its

relative ends spot welded, or otherwise secured, to the upper corners of upright flange portions 34 and 35. The crossbar 38 reinforces the angle irons 32 and 33 and is at the forward end of the trackway B. With washer plate 25 secured under plate 20 as indicated, the trackway B is in relatively permanently installed relationship for mounting the cam frame C and carrier platform D, in a ready to use position as shown in Figure 3.

The cam frame C is a relatively open frame having a flat bottom or a plate base 40, upstanding side walls 41 and 42 and an upwardly slanting open-ended, open-top portion 43. The base 40 may be a closed bottom portion or, as shown, a relatively rectangularly shaped frame having a front and a rear cross bar 45 and 46, respectively, with a pair of opposite similar side edges 47 and 48 extending at right angles inwardly of the sides 41 and 42 and serving as a cam base for the carrier platform D. As indicated, the base 40 serves to support the carrier platform D in a cam like relationship relative to the trackway, as shown in Figures 3 and 4. This cam like relationship is provided by the gradual increase in depth from the front, or leading edges 49 and 50 to the rear, or back edges 51 and 52, respectively, of walls 41 and 42 in conjunction with top 43. The top 43 is provided for by a pair of opposed right angularly extending flanges 53 and 54, integral with or otherwise suitably connected to the gradually upwardly inclined top edges of walls 41 and 42, respectively. A cross piece 55 connects the flanges 53 and 54 at the back end of slanting top portion 43. The leading end of top 43, comparable to leading edges 49 and 50, opposite the cross piece 55 is open to enable flanges 53 and 54 to slide onto and over the flange portions 36 and 37, respectively, of trackway B. The side walls 41 and 42 are spaced by base 40 and top 43 just far enough apart to permit the frame C to slide onto and over the flanges 36 and 37 to the point where cross pieces 55 may abut against the rear of angle irons 32 and 33.

The carrrier platform D comprises a flat plate 60 having at its opposite side edges down turned wall portions 61 and 62. As in the construction of the frame C, the forward ends 63 and 64 of wall portions 61 and 62, respectively, form a narrow end thereof and the back or rear end of the walls are the leading edges of carrier platform D and relatively of a height which with the greater height of the back edges, as represented by 65, provides the walls 61 and 62 with inclined upper edges, to which the inclined top 60 is integrally, or otherwise attached. The incline of top 60 is on a relative lower plane parallel to the plane of the top 43, of frame C, to afford a cam-like riding relationship of the carrier platform D in the frame C, as hereinafter described.

Spot welded, or otherwise suitably secured, to the top 60 is a rectangular frame formed by parallel sides 68 and 69 conneced to end closures 70 and 71. With the top 60 serving as a base or bottom for the enclosure walls 68, 69, 70 and 71, there is formed a container for plastic material, such as fire clay, molding clay or other relative mobile mass of shape forming substance capable of being forced into apertures, as illustrated by 26, 21 and pour hole 12, to seal the same against an outflow of liquid metal therefrom. The container sides 68 and 69 are secured to the top 60 inwardly of the plane of the walls 61 and 62, respectively, and in a relatively spaced relationship to the inner edges of the flanges 53 and 54, respectively, so as to be freely slidable between flanges 53 and 54 in a relatively upwardly and forwardly directed path to move the container, as described, in relatively close relationship to the base of plate 25, wall 27 and aperture 26 for cooperational relationship therewith, in a manner as hereinafter described.

The front end 70, of the container, is spaced relatively closely adjacent the leading or forward edge of top 60, as indicated, and the rear or back edge 71 is spaced relatively closely adjacent the rear or trailing edge of top 60, as indicated. The spaced siding 68 and 69, with their end walls 70 and 71, provide for placing, from time to time, relative freshly prepared masses of fire clay E or like plastic masses packed therebetween on the base 60. Such plastic masses (as at E) are generally packed to the top level of the container sides 68, 69, 70 and 71, or only slightly thereabove, so that the carrier platform D will ride under the cross piece 55, on frame C, in the manner shown in Figures 3 and 4. A back wall 74, extending between the sides 61 and 62, serves as a mounting for a push rod connection 75. The connection 75 may be spot welded or otherwise conventionally attached to wall 74 and the outermost end of the connection 75 is provided with screw threads (not shown) or other frictional binding to mount a push handle 76 thereon.

As is shown in Figures 3 and 4, when plate element 25 is attached, as by spot welding or other suitable connection, to plate 20, the trackways 32 and 33 are mounted under the pour hole 12 in a parallel relationship with the base of the container A. Thereafter, as shown in Figure 3, the flanges 53 and 54 are slid onto and over the flanges 36 and 37, to position the frame C in riding relationship under the pour hole 12. This provides a mounting relationship for the plastic carrier C which is positioned in an operative relationship, or ready to operate relationship on the now inclined plane of base 40. That is, the lower surface of walls 63 and 64 will now ride on the inclined plane of base 40, along the flanges 47 and 48, and carry or lift the open top container frame, as described, upwardly, through and between the flanges 53 and 54 in relatively close riding relationship under plate 26 and depending wall 27 positioned between the trackways 32 and 33.

As indicated, the arrangement is shown in Figure 3 with the frame C positioned under the trackway B, with the openings between top flanges 53 and 54 and base flanges 45, 46, 47 and 48 permitting flow of liquid metal therethrough. The container, as described, on carrier D is normally filled to the top level with an unset relatively flexible plastic mass of fire clay, or suitable plastic hole stopper material, and mounted partially within the frame C with the forward end, represented by ends 63 and 64, just clear of the flow of melted metal from pour hole 12. From this position the plastic carrier D is ready to be pushed under pour hole 12 upon an application of pressure to the handle 76. Thus, when the container, as indicated, on plastic carrier D is filled with a plastic supply of fire clay E, a push on the handle 76 forces the carrier D to ride upwardly and forwardly on the inclined base 40. The base 40 acts as a cam surface relative to the plastic carrier D. This cam surface serves to move the bulk body of the plastic against the inside curvature of wall 27. As the carrier D is pushed further into frame C, the wall 27 gathers and holds the plastic as a mass portion which is forced outwardly through aperture 26 into the pour hole 12. This gathered mass of plastic fire clay, or other suitable plastic, serves to close the pour hole 12 and prevents spillage of liquid metal from the ladle A, as an emergency stopper, in the event the normal stopper rod end 16 fails to operate properly.

Modified applications to the sides of container strucures may be provided, in similar cooperative relationship as an emergency stopper to an outlet therefore. In such an arrangement, the plastic contemplated is a relatively solid body, compared to liquid, and will not normally flow with the carrier D positioned in a relatively vertical plane ready for a forceful shove or push, in the manner as described.

Another advantage is in applying the emergency stopper to close the pour hole upon completion of pour with the stopper rod left open. This eliminates positioning the ladle on a mound of sand or the like preparatory to removing stopper before cleaning ladle.

In accordance with the patent statutes, I have described the principles of construction and operation of my emer-

gency stopper for ladle pour holes, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following claims without departing from the spirt of my invention.

I claim:

1. In combination with the pour hole of a ladle for molten metal, an apertured plate member, a wall depending in spaced relationship from said plate member adjacent to and extending partially about said aperture, a trackway supported from said plate member, an open top frame supported by said trackway, a cam surface on said frame, an open top container, a frame supporting said container on said cam surface of said frame, and a handle on said frame supporting said container, whereby a plastic material when placed in said container is forced by said wall into said pour hole upon forcing said frame supporting said container to ride over said cam surface and said open top frame to ride forwardly on said trackway.

2. A combination of a trackway, an open top frame for riding on said trackway, and a plastic carrier for riding in said frame, said trackway comprising a spaced track means for supporting said frame, a plate means having an aperture therethrough relatively centered between said track means, supporting said track means and a relatively U-shaped wall depending substantially about a half portion of said aperture; said frame for riding on said trackway comprising a base portion, inclined side walls on said base portion spaced to ride over the sides of said track means, inclined flange means extending at right angles to the inclined edge of said wall means and spaced to ride on said track means under said plate means; said plastic carrier comprising an inclined base plate, inclined side walls supporting said base plate, a rectangular frame forming an open top container for plastic material on said base plate, and a handle means on said carrier for forcing said plastic carrier to ride over the said base portion of said open top frame when in riding relationship on said trackway.

3. In combination with the pour hole of a ladle for molten metal an emergency structure for forcing a plastic material into the pour hole for closing the same, said emergency structure comprising track structure supported under said pour hole, wall means supported between said track structure adjacent said pour hole, an open top frame

supported on said trackway having an inclined base relative to said wall structure, and a container for plastic material to close said pour hole supported in riding relationship on said inclined base, whereby when said container is filled with a plastic material and forced to ride in said container on said inclined base the plastic material is forced by said wall means supported between said trackway into said pour hole to close the same as an emergency stopper.

4. An emergency stopper structure for closing an opening with a plastic material comprising a pair of spaced trackways, plate means for supporting said trackways and having an aperture therein relatively centered with respect to said trackways, a relative semi-circular wall means depending from said plate means in relative closely spaced relationship about a portion of said aperture and substantially across the spacing between said trackways, an open top sliding frame supported by said trackways having inclined side walls supporting an inclined base, an open top container supported by a base mounted on inclined side walls supported on the said inclined base, and handle means for forcing said inclined side walls to ride over said inclined base to move said container upwardly in closely riding relationship under said relative semi-circular wall means, whereby when said container is filled with a plastic the said wall engages thereagainst and the movement of said container forces the plastic into and through said aperture to block the same to fluid flow.

5. The structure of claim 4 wherein the inclined plane of said side walls supporting said inclined base is on the same plane as the said base mounted on inclined side walls supported on the said inclined base and the said open top container rests in substantially parallel relationship between said spaced trackways in operative relationship under said aperture and relative semi-circular wall means.

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