LADLE WITH STOPPER MECHANISM

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Ladle with Stopper Mechanism

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7 Claims

ABSTRACT OF THE DISCLOSURE

A ladle for molten metal has an outlet opening in its bottom between a pair of vertical passages. A stopper for the upper end of the outlet is supported by a cross member which in turn is supported by vertical members extending down through the two passages to operating means, by which the vertical members are raised and lowered to operate the stopper.

It is among the objects of this invention to provide a ladle stopper which can be operated from beneath the ladle by means that are not exposed to the stream of molten metal pouring from the ladle when the stopper is raised.

In accordance with this invention, a ladle for molten metal has a bottom wall provided with an outlet opening between a pair of vertical passages through that wall. A stopper for the upper end of the outlet opening is fastened to the central portion of a cross member in the ladle above the stopper and vertical passages. Vertical members are connected at their upper ends to the lower ends of the cross member and extend down through the vertical passages, with their lower ends connected to operating means by which they can be raised and lowered to open and close the outlet opening.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

FIG. 1 is a fragmentary horizontal section of a ladle showing the invention in plan;
FIG. 2 is a vertical section take on the line II—II of FIG. 1; and
FIG. 3 is an enlarged vertical section taken on the line III—III of FIG. 2, but with the stopper raised.

Referring to FIGS. 1 and 2 of the drawings, a metal ladle 1 of any suitable construction is provided in its bottom with an opening 2. The ladle has a refractory lining 3 provided with an outlet opening 4 in line with the ladle opening. Fitting in the outlet opening is a vertical refractory tube 5 forming a nozzle. The tube may be supported by a metal ring 6 held in the ladle opening by studs 7 extending down through a portion of the ring underlying the metal ladle. The lower ends of the studs are provided with fasteners 8 supporting the ring.

The entrance to the upper end of the nozzle opening normally is closed by a refractory stopper 10 which, in accordance with this invention, is connected to the central portion of a horizontal cross member. As shown in FIG. 3, this cross member has a core formed from a metal bar 11 surrounded by a housing of refractory material that will withstand the molten metal in the ladle. The housing is formed from a sleeve 12 fitting around the bar and projecting beyond its ends, with refractory plugs 13 closing the ends of the sleeve. A metal stem 14 projects from the top of the refractory stopper and is screwed into an opening in the bottom of the metal bar, with the top of the stopper engaging the bottom of the refractory housing.

Near each end of the metal bar it is provided with an upwardly extending threaded opening, in which the upper end of a metal post 16 is screwed. The posts may be solid or tubular. They extend down through two vertical passages 17 through the bottom wall of the ladle at opposite sides of the nozzle. The passages are considerably larger in diameter than the posts, so that the latter can be protected by encircling refractory sleeves 18 extending down into the passages, the side walls of which the sleeves slidably engage. The tops of the sleeves are held against the bottom of the cross member housing by means of nuts 19 screwed onto the lower ends of the posts and up against the bottoms of the sleeves.

The lower ends of the posts project below the ladle and are pivotally connected to the central portions of the forks of a forked lever 21 (FIG. 1) located below the ladle. The outer ends of these forks are pivotally connected to brackets 22 fastened to the bottom of the ladle. When the opposite end of the lever is raised, the lever will lift the posts.

Although this can be done by hand, it is preferred to do it by means of an hydraulic cylinder 23 secured to the side of the ladle and having a piston rod 24 projecting from its lower end and pivotally connected to the underlying end of the lever.

When fluid pressure is delivered to the lower end of the cylinder it will raise the lever, which in turn will lift the vertical members and the cross member and thereby remove the stopper from the upper end of the nozzle as shown in FIG. 3. Since the molten metal pours from the nozzle between the forks of the lever, there will be no danger of it striking the lever or the lower ends of the posts because all of them are spaced laterally a considerable distance from the lower end of the nozzle. When the stopper or any part of the cross member or vertical members needs replacement, the lower ends of the posts can be disconnected from the lever and then the assembly inside of the ladle lifted out of the top of the ladle.

I claim:
1. A ladle for molten metal, comprising a bottom wall provided with an outlet opening between a pair of vertical passages through that wall, a stopper in the ladle for the upper end of said outlet opening, a cross member above the stopper and passages, means fastening the stopper to the central portion of the cross member, vertical members connected at their upper ends to the opposite ends of the cross member and extending down through said passages, and operating means spaced laterally from said outlet below said bottom wall connected with the lower ends of said vertical members for raising and lowering them to open and close said outlet opening.

2. A ladle according to claim 1, in which said cross member includes a metal cross bar secured to the upper ends of said vertical members, a refractory sleeve fitting around the bar and projecting beyond its ends, and refractory plugs closing the projecting ends of the sleeve.

3. A ladle according to claim 1, in which each of said vertical members includes a metal post extending from said cross member down to said operating means and spaced from the side of the surrounding passage, and a refractory sleeve mounted on the post and extending from said cross member down into said passage in sliding engagement with the side of the passage.

4. A ladle according to claim 3, in which the lower portions of the posts are provided with screw threads, and nuts are screwed onto the posts to hold said sleeves tightly against said cross member.

5. A ladle according to claim 1, in which said operating means include a forked lever, means operatively connecting the inner ends of the forks with the lower ends of said vertical members, means pivotally connecting the outer ends of the forks to the bottom of the ladle, and means for raising and lowering the opposite end of the lever.

6. A ladle for molten metal, comprising a bottom wall provided with an outlet opening between a pair of vertical
3 passages through that wall, a stopper in the ladle for the upper end of said outlet opening, a metal cross bar above said stopper and passages, means fastening the stopper to the central portion of the bar, a refractory housing enclosing the bar, a pair of vertical metal posts connected at their upper ends to the opposite ends of the bar and extending therefrom down through said housing and passages, the posts being spaced from the sides of said passages, a refractory sleeve rigidly mounted on each post and extending from said bar housing down into said passages in sliding engagement with the sides of the passages, a forked lever below said bottom wall straddling said outlet opening, means pivotally connecting the lower ends of said posts to the forks of the lever, means for swinging the lever up and down to move said stopper vertically.

7. A ladle according to claim 6, in which the lower portions of said posts are provided with screw threads, and nuts are screwed onto said threads to press said sleeves tightly against said bar housing.

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