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W. W. SHAWL

LADLE CAGE

Filed June 19, 1925

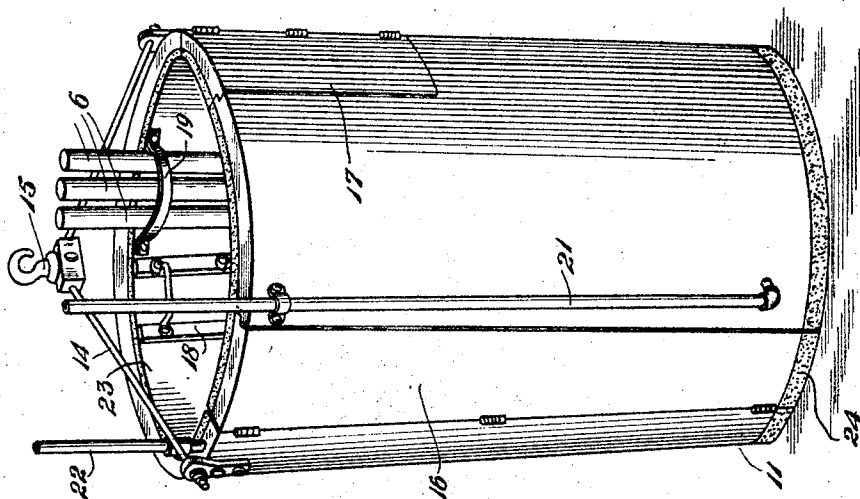


Fig. 2

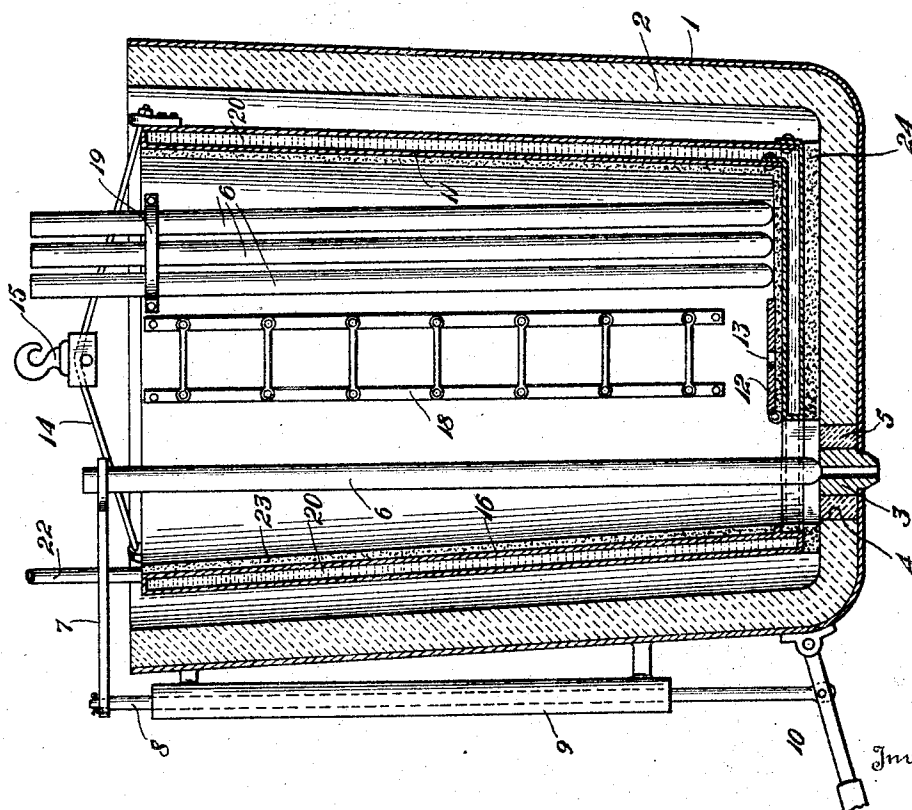


Fig. 1

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UNITED STATES PATENT OFFICE.

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LADLE CAGE.

Application filed June 19, 1925. Serial No. 38,240.

To all whom it may concern:

Be it known that I, WALTER W. SHAWL, a citizen of the United States, residing at North Industry, in the county of Stark and State of Ohio, have invented certain new and useful Improvements in Ladle Cages, of which the following is a specification.

This invention relates to a cage adapted to be temporarily placed within a ladle such as is used for receiving molten steel or alloy from an open hearth or electric furnace and pouring the same into ingot molds or the like, the cage being designed to shield the workmen from the intense heat of the ladle during the time they are replacing the pouring nozzle in the ladle and setting the stopper rod therein.

In the manufacture of steel or alloy ingots the steel or alloy is mixed in the proper proportions in an open hearth or electric furnace and melted, and at the proper time the molten metal is poured from the furnace into a ladle of sufficient proportions to receive the entire charge of the furnace, usually about one hundred tons. This ladle is in the form of a large bucket, formed of steel and having a fire brick lining, a pouring nozzle, usually of fire brick, being provided in the bottom of the ladle for pouring the molten steel into the usual ingot molds, a stopper rod being operable within the ladle to shut off the pouring nozzle as the ladle is moved upon a crane from one mold to the next or as the molds are moved upon cars beneath the ladle.

This mass of molten metal surrounding the stopper rod and passing through the pouring nozzle burns out both of these parts very rapidly, making it necessary to replace the same after the pouring of each heat. Owing to the intense heat to which the ladle is subjected, during the pouring operation, it is necessary that the ladle be permitted to cool for several hours after each heat is poured, before the workmen can enter the same to replace the pouring nozzle and stopper rod. As the pouring nozzle is set in soft fire clay, a wood fire is built over the same and kept burning for several hours to harden or bake the fire clay before the

next heat is poured. Thus the ladle is kept out of use for the greater part of the time, and when it is finally in condition for receiving another heat from the furnace it has cooled to such an extent that it frequently has a bad effect upon the molten steel or alloy which is poured into the same, quickly chilling the metal which contacts with the ladle and often causing the loss of many tons of metal which hardens around the walls of the ladle before it can be poured therefrom.

Under present steel mill practice in order to conserve time and place the ladle in use as soon as possible after each heat has been poured, the workmen enter the ladle and start the resetting of the pouring nozzle and stopper rod as soon as the ladle has cooled to approximately 300° F. This of course is an extreme temperature in which to work and not only causes hardship to the workmen but is responsible for their hurrying with the work of resetting the nozzle and stopper rod, often resulting in poor workmanship which causes a considerable loss in the next heat of metal which is poured from the ladle.

The object of the present invention is to provide a cage of slightly smaller diameter than the interior of the ladle and arranged to be lowered into the ladle as soon as a heat has been poured therefrom, protecting the workmen from the intense heat of the ladle while they re-set the pouring nozzle and stopper rod, suitable doors being provided in the cage through which they may work to accomplish the same. The green fire clay which is tamped around the pouring nozzle will be quickly baked by contact with the highly heated fire brick and shell of the ladle, thus making it unnecessary to build a wood fire over the same, and permitting the ladle to be placed in operation within a very short time after a heat has been poured.

The above and other objects may be attained by forming a steel cage provided with suitable doors in its bottom and side-walls through which the workmen can reach to do the necessary work and which will permit the cage to be withdrawn from the ladle

without interfering with the stopper rod and goose neck; the side and bottom walls of the cage being water jacketed and lined with asbestos if desired, and means being provided for suspending the cage from a crane.

An embodiment of the invention is illustrated in the accompanying drawing, in which,

Figure 1 is a sectional view through a ladle of usual form showing the improved cage located therein, and

Fig. 2, is a perspective view of the cage.

Similar numerals of reference indicate corresponding parts throughout the drawing.

A ladle is conventionally shown in Fig. 1, having the usual steel shell 1 and fire brick lining 2, and provided with the fire brick pouring nozzle 3 which is set in the opening 4 of the fire brick lining by means of fire clay which is tamped around the same as shown at 5.

The stopper rod 6 co-operates with the nozzle to normally shut off the flow of metal through the same and is operated through the goose neck 7 and sliding rod 8 which is vertically moved through the tubular guide 9 as by a manually operated lever 10.

This pouring nozzle 3 and stopper rod 6 must be replaced after each heat is poured, making it necessary for the workmen to crawl down inside the ladle after the same has sufficiently cooled, to replace these parts. Owing to the enormous capacity of the ladle several hours are required for the same to cool sufficiently to permit the workmen to enter the same for doing this work, which is usually done when the ladle has cooled to substantially 300° F.

After the nozzle 3 has been re-set and the fire clay 5 tamped around the same, a wood fire is built over the green fire clay and kept burning for several hours to thoroughly bake the same before another heat can be poured into the ladle. Thus the ladle is kept out of commission for a considerable period of time and when again ready for use it is substantially cold, quickly cooling the molten metal which is poured therein from the furnace, often causing the loss of a considerable portion of the metal.

In order to permit this nozzle and stopper rod to be replaced immediately after the pouring of a heat from the ladle, I have provided a cage adapted to be lowered into the ladle immediately after a heat has been poured, to protect the workmen, who are inside of the cage, permitting the ladle to be replaced in use within a very short time after the pouring of each heat and before the same has cooled sufficiently to damage the molten metal poured therein.

This cage is in the form of a steel bucket 11 of less diameter than the interior of the ladle and provided in its bottom wall with

a hinged door 12 which may be opened to permit the nozzle 3 to be set, a peep hole 13 being provided in the door to permit the workmen, inside of the cage, to properly locate the nozzle as the cage is lowered into the ladle.

A bail 14 may be located at the upper open end of the cage and provided with a swiveled hook 15 for engagement with the usual chain upon the crane in order that the cage may be turned upon its vertical axis and properly positioned within the ladle.

A hinged door 16 is preferably provided in the sidewall of the cage, in alinement with the door 12, and adapted to be opened when the cage is raised or lowered in order to accommodate the goose neck 7 and stopper rod 6. A similar door 17 may also be provided in the upper portion of the sidewall of the cage to permit a workman to reach therethrough to chip any metal which may be frozen upon the fire brick lining of the ladle.

A ladder 18 may be formed upon the inside of the cage to permit the workmen to enter or leave the same, and a supply of stopper rods may be carried in a rack 19 formed adjacent thereto. The workmen may thus enter the cage with all of their tools and other necessary apparatus, after which the cage is lowered into the ladle and the work may be completed while the workmen are shielded from the heat of the ladle, thus permitting them to take sufficient time to properly set the nozzle and stopper rod.

The cage may be provided with a water jacket 20 through which cold water may be continuously circulated as by the inlet pipe 21 communicating with the lower portion of the water jacket and arranged to be connected by a flexible hose with a spigot, an outlet pipe 22 being connected to the upper end of the water jacket and arranged to be connected by a similar hose with a suitable drain.

A lining 23 of asbestos or similar material may also be provided around the interior of the cage if desired, and a heavy layer 24 of asbestos or the like may be provided underneath the bottom of the cage for contact with the heated fire brick in the bottom of the ladle.

The workmen will thus be protected from the intense heat of the ladle and may replace the nozzle and stopper rod almost immediately after a heat has been poured from the ladle, and the green fire clay which is tamped around the nozzle will be quickly baked by the heat from the ladle.

I claim:

1. A protective cage adapted to be placed within a steel pouring ladle, and having an opening through which a workman may reach the interior of the ladle.
2. A protective cage adapted to be placed

within a steel pouring ladle, and having a door in its bottom through which a nozzle may be placed in the ladle.

5 3. A protective cage adapted to be placed within a steel pouring ladle, and having a door in its side wall to accommodate the goose neck of the ladle.

10 4. A protective cage adapted to be placed within a steel pouring ladle, and having a door in the upper portion of its side wall through which a workman may reach the interior of the ladle.

15 5. A protective cage adapted to be placed within a steel pouring ladle, and having a bail at its upper end for connection to a hoisting means.

6. A protective cage adapted to be placed within a steel pouring ladle, and having a layer of high heat resisting material upon its bottom.

20 7. A protective cage adapted to be placed within a steel pouring ladle, and a water jacket formed in the walls of said cage.

8. A protective cage adapted to be placed within a steel pouring ladle, a water jacket 25 formed in the walls of said cage, and means for continuously circulating cooling water through said jacket.

In testimony that I claim the above, I have hereunto subscribed my name.

WALTER W. SHAWL.