April 30, 1963 C. J. BURCH 3,087,212

HINGED HEAT SHIELD FOR METAL TEEMING LADLE BOTTOMS

Filed April 5, 1960

FIG. 1

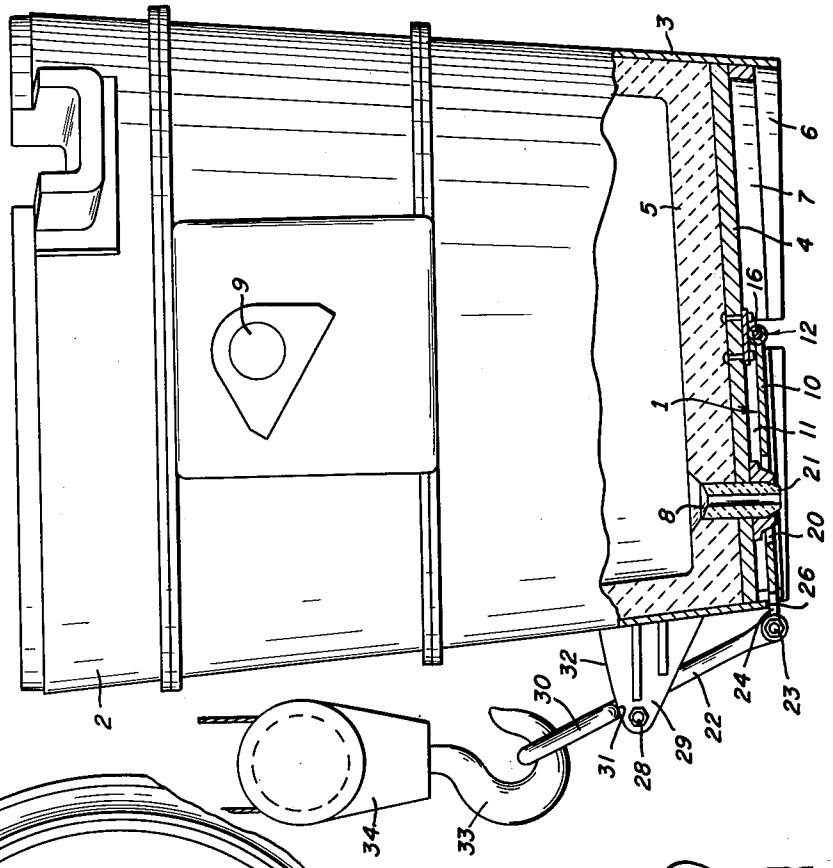


FIG. 2

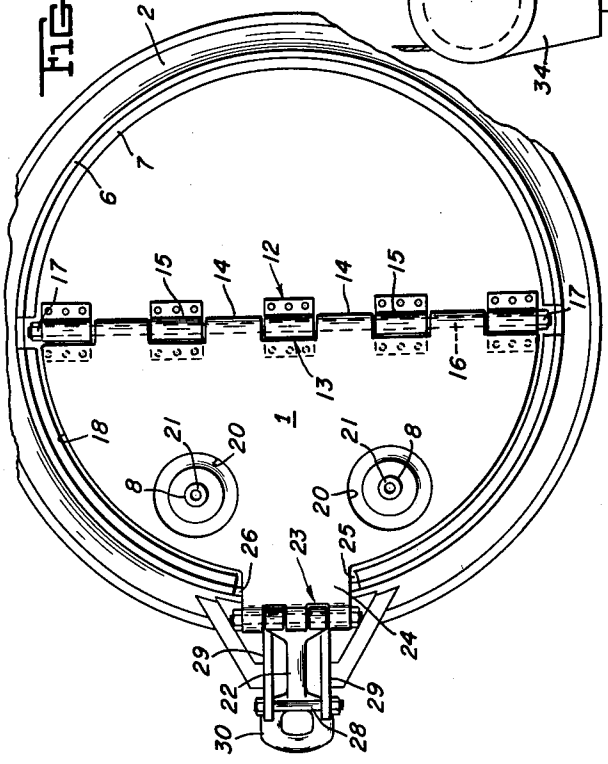
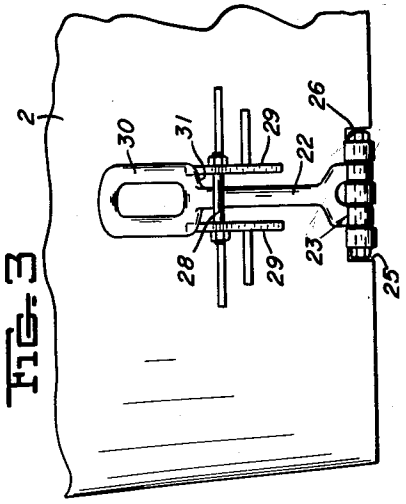


FIG. 3



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3,087,212
HINGED HEAT SHIELD FOR METAL TEEMING LADLE BOTTOMS

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This invention relates to refractory lined ladles for teeming molten metal into ingot molds and, as indicated below, is directed to a heat shield in the form of a semicircular plate that is hinged to the bottom of a ladle for protecting it against radiant heat particularly in the area about the nozzle opening through which molten metal is teemed into an ingot mold. In a manner to be described, the hinged semicircular plate of this invention, in addition to its heat shielding action, forms a part of and provides improvements in a linkage system for imparting tilting movement to a ladle.

Ingot teeming ladles for transferring molten metal from open hearths and other metallurgical furnaces have pouring nozzles in the bottoms thereof through which metal is teemed into ingot molds. After being filled with molten steel, a ladle of this character is positioned over an ingot mold and its nozzle stopper rod is lifted to teem molten metal into an ingot mold positioned underneath the ladle. Due to the intensity of the heat radiating from the molten steel in underlying molds, the ladle bottom is weakened and subjected to severe internal stresses, particularly in the bottom area about the teeming nozzle which is positioned directly over the ingot mold. As a consequence, cracks develop in the ladle bottom in a direction extending radially from the nozzle, indicating the adverse effect of excessive heat in this sector of the bottom. While attempts have been made to minimize damage of this character by mounting steel plates as heat shields in permanently attached positions separated from the ladle bottom by an air space, protective shields of this character are not used over the ladle bottom area in which the teeming nozzle is located because of the resulting inaccessibility of the nozzle area.

One of the principal objects of this invention is to provide a heat shield for ladle bottoms that provides protection against the damaging effect of radiant heat in the area immediately about the teeming nozzles therein. For this purpose, a semicircular plate is employed as a heat shield and is hinged to the ladle for pivotal movement about an axis parallel to the ladle trunnions to a position in which it covers and forms a shield for the portion of the ladle bottom in which the teeming nozzle or nozzles are located. A further and related object of the invention is to provide a hinged heat shield of this character as part of an extensible toggle-linkage system for effecting tilting movement of the ladle about its supporting trunnions.

Other objects and advantages of the invention will become apparent from the following description.

In the drawings, there is shown a preferred embodiment of the invention.

In this showing:

FIGURE 1 is an elevational view of a teeming ladle in which a fragmentary lower portion thereof is broken away and shown in vertical section to illustrate the application thereto of the heat shield of this invention;

FIGURE 2 is a bottom plan view of the ladle shown in FIGURE 1; and

FIGURE 3 is a fragmentary elevational view taken in a direction looking from the left of FIGURE 1.

In the drawings, the heat shield 1 of this invention is shown applied to a metal teeming ladle 2 of essentially conventional construction. The ladle 2 comprises a steel shell 3 that forms the side wall thereof, a circular steel bottom plate 4, and a refractory lining 5 on the interior thereof. The lower end of the shell 3 is extended below the plate 4 to provide an annular flange 6 by which the ladle may be supported on a floor structure. A retaining ring 7 welded to the internal surface of the flange 6 in a position below the plate 4 furnishes a reinforcement for the flange 6 and a support for the bottom plate 4 on the shell 3. A pair of teeming nozzles 8, controlled by stopper rods (not shown), are provided in the ladle bottom for teeming molten metal into ingot molds. The ladle 2 further has a pair of trunnions 9 (only one of which is shown in FIGURE 1) projecting from its side wall at diametrically opposite points by which it is supported for pivotal movement in a conventional manner to enable its being tilted to an inverted position for the removal of slag and skull therefrom.

The heat shield of this invention comprises a semicircular steel plate 10 that is normally supported in a position as best shown in FIGURE 1 parallel to and below the ladle bottom plate 4 in such manner that an air space 11 is provided between the ladle bottom plate 4 and the heat shield plate 10. A hinge 12 arranged along the chordal edge 13 of the plate 10 supports it on the ladle bottom for pivotal movement about an axis below the ladle bottom plate 4 and parallel to the axis of the trunnions 9. The hinge 12 is comprised of hinge elements 14 at spaced intervals along the length of the chordal edge 13 and arranged between hinge elements 15 secured to the bottom plate 4, and a hinge pin 16 extending through the hinge elements 14 and 15. The hinge pin 16 is held against endwise movement by nuts 17 on opposite ends thereof. The plate 10 has a radius slightly less than the inner radius of the annular flange 6 so that its arcuate edge 18 fits closely within the inner surface of the flange 6 when in its horizontal and operative heat shielding position as shown in the drawings. In this position, openings 20 in the plate 10 are axially aligned with the axes of the nozzles 8 so that the lower ends 21 of the nozzles 8 project through the plate 10 to provide for teeming metal into ingot molds positioned under the ladle 2. The support for the plate 10 on the ladle that is provided by the hinge 12 provides for its pivotal movement to a vertical position clear of the nozzles 8 for their removal and replacement when necessary.

The plate 10 is held in the horizontal position shown in FIGURE 1 of the drawings by a releasable connection that includes an operating lever 22 and a pivotal connection 23 at the lower end of the lever 22 with a tongue 24 formed integrally with and projecting outwardly from the arcuate edge 18 of the plate 10. The ladle flange 6 and reinforcing ring 7 are cut away at a point opposite the center portion of the arcuate edge 18 to provide an opening 25 in which the tongue 24 is received and held by the operating link 22 against the upper edge 26 of the opening 25.

As indicated above, the heat shield of this invention in the form of the hinged semicircular plate 10 forms a part of a linkage-system for imparting tilting movement to the ladle 2 about its trunnions 9. In this respect, the plate 10, lever 22, and the pivotal hinge connections 23 and 12 form an extensible toggle-linkage for tilting the ladle 2 and of the character disclosed, for example, in Patent No. 2,881,488, issued April 14, 1959, to F. M. Schweinberg. As shown in this patent, the link 22 is held in the position shown in FIGURES 1 and 3 of the drawings extending angularly upwardly and outwardly relative to the ladle 2 and plate 10 by a pin 28 that is removably mounted in a pair of brackets 29 secured to the ladle side wall 3. An eyelet 30 at the upper end of the link 22 provides shoulders 31 that engage the upper edges 32 of

the brackets 29 to hold the link 22 and the semicircular plate 10 against lowering movement relative to the ladle 2. When replacement of the nozzles 8 is necessary, the holding pin 28 is removed from the brackets 29 so that the link 22 may be pivoted outwardly to a position in which the shoulders 31 clear the brackets 29 to permit lowering movement of the link 22 and pivotal movement of the plate 10 downwardly to a vertical position in which it is clear of the area about the nozzles 8.

When tilting movement of the ladle 2 about its trunnions 9 is required for the removal of slag and skull therefrom, a hook 33 of a cable operated auxiliary hoist 34 is engaged in the eyelet 30 at the upper end of the lever 22 as shown in FIGURE 1 of the drawings. After removal of the holding pin 28 from the brackets 29, upward movement of the hoist 34 will operate to straighten the toggle-linkage that is formed by the lever 22, the plate 10, and the pivotal connection 23 therebetween, to tilt the ladle 2 about its trunnions as explained in the above mentioned Patent No. 2,881,488. The use of the plate 10 as one of the pivotal links of the ladle tilting mechanism in this manner provides an advantage in that the ladle flange 6 may be fabricated with a shorter axial dimension, and it is thus possible to lower the teeming position of the ladle over molds and thereby minimize the height of fall of the steel into the molds, and consequent splashing of the teeming metal.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. In a refractory lined steel ladle for teeming molten metal, a circular plate forming the bottom of said ladle, a teeming nozzle opening through said ladle bottom plate, a semicircular plate having its chordal edge arranged along a line spaced below and parallel to a diameter of said bottom plate, hinge means mounting said semicircular plate on said bottom plate for pivotal movement about said chordal edge to and from an operative position in which it is spaced from and parallel to said bottom plate and forms a heat shield for said bottom plate, said semicircular plate having an opening therein which is axially aligned with the axis of said teeming nozzle when it is in said operative heat shielding position, and releasable means for holding said semicircular plate against pivotal movement out of its said operative heat shielding position.

2. A teeming ladle as defined in claim 1 characterized by the provision of trunnion means for supporting said ladle for tilting movement about a horizontal axis, and by said hinge means providing for pivotal movement of said semicircular plate about an axis parallel to said ladle trunnion axis.

3. In a refractory lined steel ladle for teeming molten metal, a circular plate forming the bottom of said ladle, an annular flange depending from the periphery of said bottom plate, hinge means on said bottom plate extending between diametrically opposed points on said flange and providing a pivot axis spaced below and parallel to a diameter of said bottom plate, a semicircular plate having its chordal edge supported by said hinge means for pivotal movement about said axis to and from an operative position in which it is spaced from and parallel to said bottom plate and forms a heat shield for said bottom plate, a teeming nozzle opening through said ladle bottom plate, said semicircular plate having an opening therein which is axially aligned with the axis of said teeming nozzle when it is in said operative heat shielding position, a tongue projecting outwardly from said semicircular plate at a point centrally of its arcuate edge, said annular flange having a cut-out portion in which said tongue is received when said semicircular plate is in its said operative heat shielding position, a ladle tilting link pivotally connected to said tongue at its outer edge, and means including a bracket secured to said ladle for releasably holding said tilting link in a stationary position extending angularly upwardly and outwardly relative to said ladle.

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