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[54] **COLLECTOR NOZZLE FOR SLIDABLE GATES**

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[52] **U.S. Cl.** **222/561**, 222/567, 251/144

[51] **Int. Cl.** **B22d 37/00**

[58] **Field of Search** 222/561, 566, 569, 567; 251/144

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[57] **ABSTRACT**

A collector nozzle for slidable gates used to control teeming of liquid metal from a bottom-pour vessel. A collector nozzle is a tube which is mounted integrally with the gate and extends downwardly therefrom to confine the stream of metal discharging through an opening in the gate. A conventional collector nozzle is formed of a tube of a refractory which has a relatively high thermal conductivity and which resists erosion, but is subject to having droplets of the teemed metal solidify at its discharge end and form objectionable "bugs." The invention provides a removable tip for attachment to the discharge end of the tube. The tip is a refractory of lower thermal conductivity less likely to have "bugs" form thereon.

7 Claims, 4 Drawing Figures

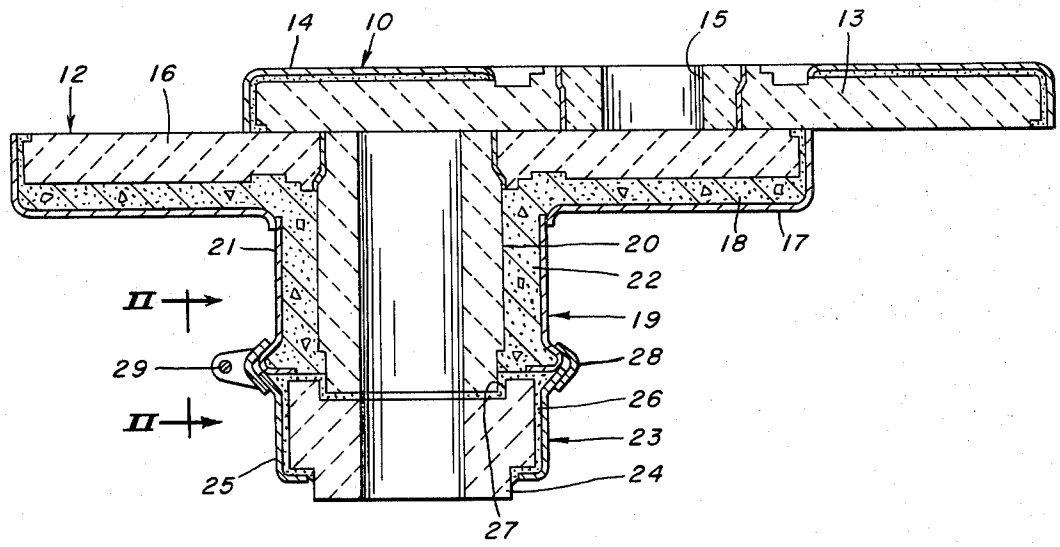


FIG. 1.

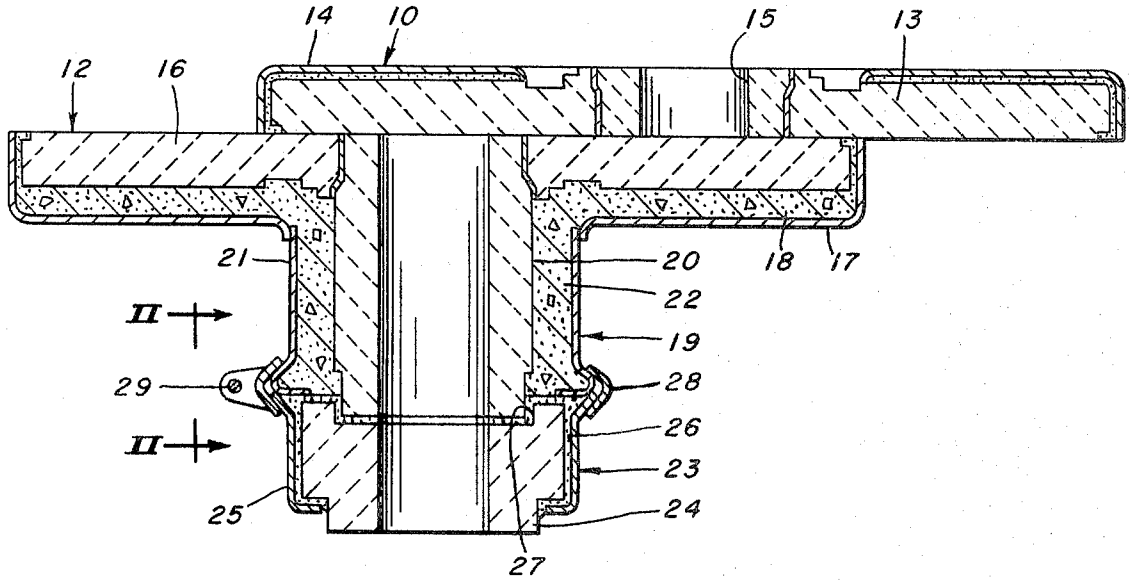


FIG. 2.

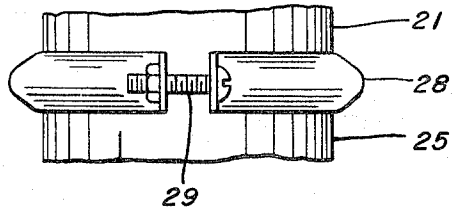


FIG. 3.

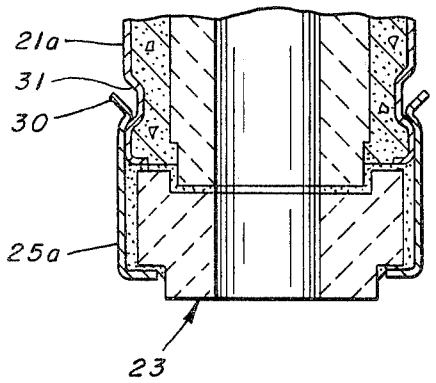
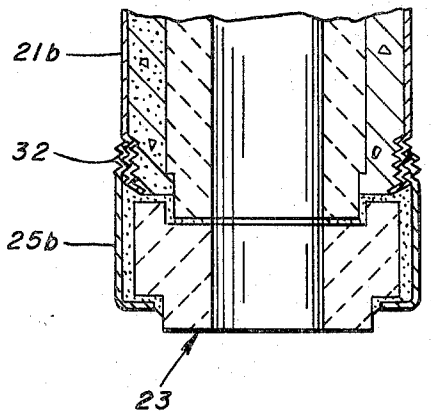


FIG. 4.



COLLECTOR NOZZLE FOR SLIDABLE GATES

This invention relates to an improved collector nozzle for slidable gates used to control teeming of liquid metal from a bottom-pour vessel.

In the slidable gate art, a "collector nozzle" is a refractory tube which is mounted integrally with a gate and extends downwardly from an opening in the gate to confine the stream of metal as it is teemed through the opening and maintain a relatively tight stream. Reference can be made to our earlier joint application, Ser. No. 150,585, filed June 7, 1971, now abandoned for a showing of a slidable gate which is intended particularly for use on ladles and which is equipped with a collector nozzle. Our improved collector nozzle may be used to advantage on a gate constructed as shown in said application, although it is apparent the nozzle may be used as well with other forms of gate.

Conventional practice is to employ an erosion-resistant refractory in a collector nozzle. The refractory at the upper portion of the nozzle immediately adjacent the gate must be capable of resisting erosion of a throttled pouring stream, and high-alumina refractories commonly are used. However, erosion-resistant refractories have a relatively high thermal conductivity which makes them less desirable for the lower portion or discharge end of the nozzle. Droplets of the teemed metal tend to solidify on the discharge end and form "bugs" which deflect the pouring stream. Sometimes such bugs drop off and contaminate the metal in the receiving vessel. The problem can be overcome by using a refractory of lower thermal conductivity at the discharge end of the nozzle than the refractory next to the gate, but the refractory at the lower portion of a nozzle thus constructed erodes more rapidly than the refractory at the upper portion. Since the gate and nozzle are integral, the whole piece must be scrapped when any small portion is eroded or damaged to an extent that it is no longer serviceable.

An object of our invention is to provide an improved collector nozzle which has a removable and replaceable refractory tip at its lower end, whereby we can use different refractories in different portions of the nozzle, yet avoid the need of scrapping the whole piece because of damage to a small portion at the discharge end.

A further object is to provide a replaceable tip which can be attached to a collector nozzle to afford a discharge end not likely to be affected by "bugs".

In the drawing:

FIG. 1 is a vertical sectional view of a portion of a slidable gate mechanism equipped with our improved collector nozzle;

FIG. 2 is a side elevational view on line II—II of FIG. 1;

FIG. 3 is a fragmentary view similar to FIG. 1, but showing a modification; and

FIG. 4 is another fragmentary view similar to FIG. 1, but showing another modification.

FIG. 1 shows diagrammatically a top plate **10** and a slidable gate **12** which form part of a mechanism for controlling teeming of liquid metal from a bottom-pour vessel. The remainder of the mechanism, as well as the vessel itself, may be of any standard or desired construction, for example as shown in the aforementioned application. The top plate **10** is formed of a refractory body **13** and a metal frame **14** and has a teeming opening **15.** The gate **12** is formed of refractory body **16,** a metal frame **17,** and a layer of refractory cement **18** between the body and frame. The gate includes an integral downwardly extending collector nozzle **19.** The nozzle is formed of an erosion-resistant refractory tube **20,** a metal casing **21** surrounding the tube, and a layer **22** of refractory cement between the tube and casing. The tube extends through an opening in the refractory body **16** of the gate, and its upper end is flush with the upper face of the gate. The refractory of the tube commonly is high alumina, that is, about 70 to 95 percent by weight Al_2O_3, but other materials may be used, such as magnesia or a magnesia-chrome mixture.

In accordance with our invention, the lower portion of the collector nozzle **19** includes a removable and replaceable tip **23.** The tip is formed of a refractory ring **24,** a metal casing **25** surrounding the ring, and a layer **26** of refractory cement between the ring and casing. The ring forms a continuation of tube **20** and the upper face of the ring has a counterbore **27** which receives the bottom of the tube. The tip is attached to the main portion of the nozzle with a metal band **28** which surrounds the parts at their juncture. The ends of the band are held together with a bolt **29.** FIG. **3** shows a modification in which the tip is attached with spring clips **30.** The clips are integral with the casing **25***a* and extend upwardly therefrom, where they are received in a groove **31** in the casing **21***a*. FIG. **4** shows another modification in which the tip is threadedly attached to the main portion of the nozzle. The two casings **21***b* and **25***b* have interengaging screw threads **32.**

The refractory of ring **24** has a lower thermal conductivity than the refractory of tube **20.** If an alumina refractory is used in the ring, the maximum Al_2O_3 content is about 70 percent by weight. Examples of refractories of which we may form the rings are fire clay and rebonded fused silica. There is a much less likelihood of droplets of the teemed metal solidifying on these refractories than on the erosion-resistant refractory of the tube **20.** The tip **23** is a small piece and can be replaced at relatively low cost when it becomes eroded or damaged. A number of tips formed of different refractories can be stocked, and a tip of the optimum refractory for teeming any particular metal can be installed.

We claim:

1. In a slidable gate which includes a refractory gate body having an opening, and a collector nozzle mounted integrally with said body and extending downwardly from said opening, said nozzle comprising a tube of refractory which has a relatively high thermal conductivity and which resists erosion during teeming of liquid metal, a metal casing surrounding said tube, and a layer of refractory cement between said tube and said casing, the improvement which comprises a short-length removable and replaceable tip and means attaching said tip to the lower end of said tube, said tip being formed of a ring of refractory of lower thermal conductivity than the refractory of said tube and a metal casing surrounding at least the upper portion of said ring, whereby said tip resists formation of bugs on the discharge end of said nozzle and can be replaced when eroded without replacing the remainder of said tube.

2. A gate as defined in claim **1** in which said attaching means includes a band surrounding said tip and the portion of said tube thereabove.

3. A gate as defined in claim 1 in which said attaching means includes spring clips integral with said second-named casing, said first-named casing having a groove receiving said clips.

4. A gate as defined in claim 1 in which said attaching means includes interengaging screw threads on the two casings.

5. A gate as defined in claim 1 in which said tube is formed of a high-alumina refractory.

6. A gate as defined in claim 5 in which the refractory of said ring has a maximum alumina content of about 70 percent by weight and is selected from the group which consists of fire clay and rebonded fused silica.

7. A gate as defined in claim 1 in which said tip is of uniform length throughout its circumference.

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