

United States Patent [19]
Shapland

[11] 3,845,943
[45] Nov. 5, 1974

[54] REFRACTORY POURING TUBE

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[21] Appl. No.: 409,835

[52] U.S. Cl. 266/38, 222/567
[51] Int. Cl. F27d 3/14
[58] Field of Search 266/34 T, 34 PT, 34 V,
266/38; 222/566, 567; 164/66, 259, 281

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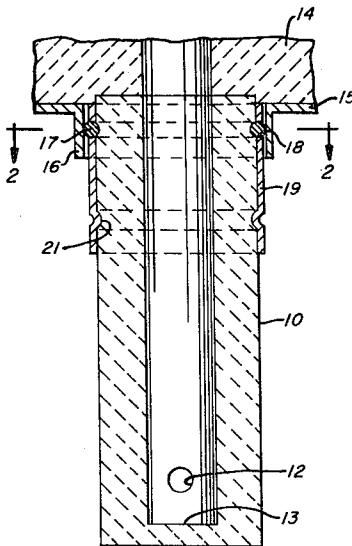
Primary Examiner—Gerald A. Dost
Attorney, Agent, or Firm—Walter P. Wood

[57]

ABSTRACT

A pouring tube for enclosing a stream of liquid metal as it passes from a tundish to a receiver such as a continuous-casting mold. The tube is formed of a refractory and is suspended from a holder with a clip. The invention is in the addition of a metal band encircling the refractory in the region engaged by the clip. The band distributes the load and prevents breakage of the refractory.

5 Claims, 4 Drawing Figures



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FIG. 1

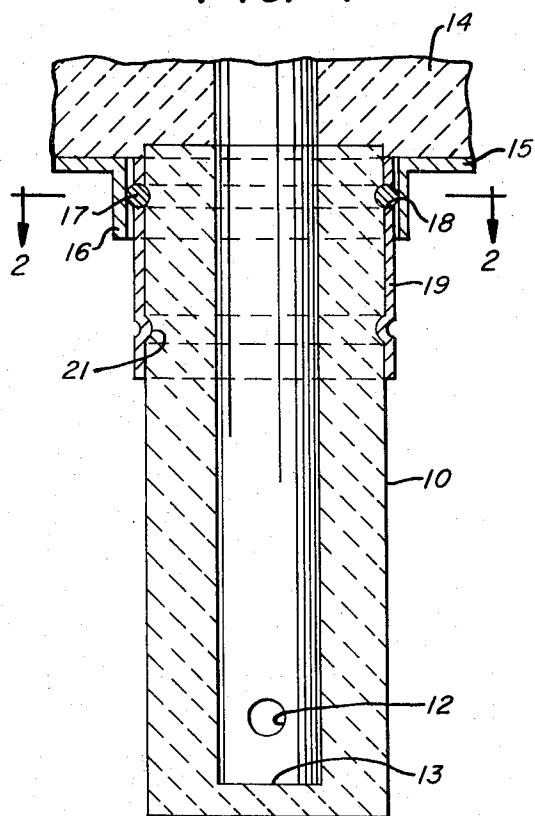


FIG. 3

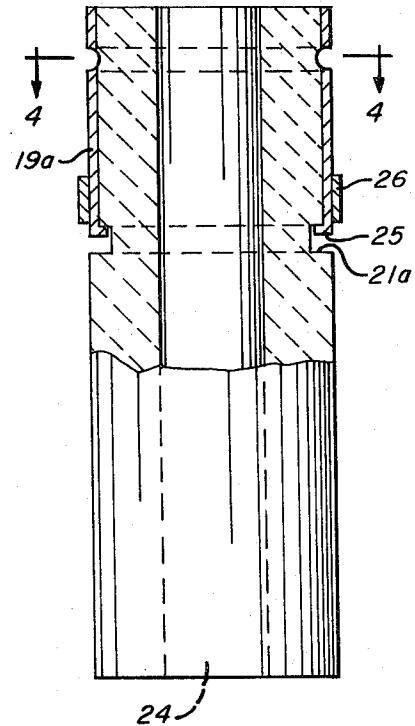


FIG. 2

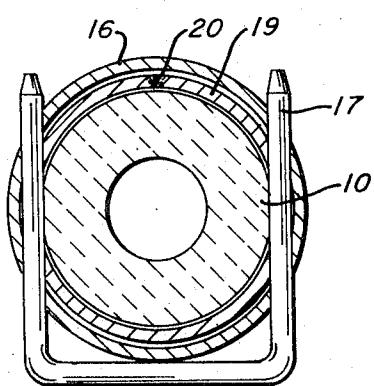
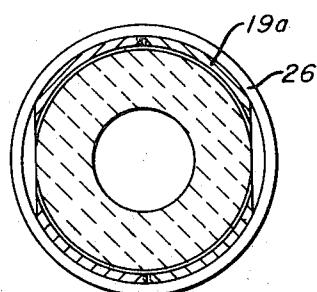


FIG. 4



REFRACTORY POURING TUBE

This invention relates to an improved pouring tube for teeming liquid metal from a bottom-pour vessel into a receiver.

Although my invention is not thus limited, the pouring tube is particularly useful for teeming steel from a tundish, which is equipped with a slideable gate mechanism for controlling discharge therefrom, into a continuous-casting mold. In continuously casting some grades of steel, it is desirable to enclose the pouring stream as it passes from the tundish to the mold and introduce the steel to the mold beneath the surface of the pool already in the mold. Conventionally this is accomplished by attaching a refractory pouring tube to the teeming vessel beneath the outlet in its bottom wall and submerging the lower end of the tube in the pool. In some instances the tube is open at its lower end, but in others the tube has outlets in the side wall and the lower end is closed. The latter type should be oriented with respect to the mold so that the streams discharging from the outlets are properly aimed. Reference can be made to my U.S. Pat. No. 3,501,068 and to Earl P. Snapland, Jr. Application Ser. No. 337,252 filed Mar. 1, 1973, both of common ownership for showings of pouring tubes.

The Earl P. Snapland, Jr. application shows a pouring tube which is attached at its upper end to a holder. The holder comprises a refractory block and a metal frame covering the side and end edges and bottom of the block. The underside of the frame has a depending skirt which receives the upper end of the tube. The skirt has four symmetrically arranged slots. A U-shaped wire clip is inserted through the slots and lies within grooves in the outside face of the refractory to attach the tube to the holder. The grooves may extend through relatively small arcs, whereby the tube is positioned automatically always in the same orientation with respect to the holder when the tube and holder are assembled.

The present invention relates to the use of a metal band on a pouring tube for the purpose of distributing the load and preventing the tube from breaking. Preferably the tube is supported by a metal clip as shown in the Earl P. Snapland, Jr. application. I point out that said application illustrates a band in accordance with the present invention, but of course does not claim it.

An object of my invention is to provide an improved refractory pouring tube, of the type which is attached to a holder with a clip, wherein the region of the refractory engaged by the clip carries a metal band for distributing the load and protecting the refractory against breakage.

A further object is to provide an improved pouring tube in which slots in a metal band encircling the refractory of the tube receive the supporting clip, whereby breakage of the refractory is largely prevented, and there need be no reliance on grooves in the refractory to support and orient the tube.

In the drawing:

FIG. 1 is a vertical sectional view of a pouring tube constructed in accordance with my invention;

FIG. 2 is a horizontal section on line II-II of FIG. 1;

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

FIG. 4 is a horizontal section on line IV-IV of FIG. 3.

FIGS. 1 and 2 show a cylindrical refractory pouring tube 10, illustrated as of the type which has diametrically opposed downwardly slanted outlets 12 in its side wall. The lower end of the tube is closed as indicated at 13. The tube is suspended from a holder which includes a refractory block 14, a metal frame 15, and a skirt 16 depending from the frame. The tube is held on the frame with a U-shaped wire clip 17 which extends through slots in the skirt and is received in grooves 18 in the outside face of the refractory. Alternatively the clip may be made as two separate pieces which extend through the slots and grooves at opposite sides. The grooves 18 extend circumferentially of the refractory but preferably only through relatively small arcs, whereby the tube automatically is oriented with the outlets 12 properly aimed when attached to the block with the clip 17. In use the lower end of the tube is submerged in a pool of liquid metal in a receiver, such as a continuous-casting mold. The structure thus far described is the invention of Earl P. Snapland, Jr. and is claimed in his aforementioned application.

In accordance with my invention, I place a metal band 19 around the tube 10 in region of the grooves 18, that is, the region engaged by the clip. The band can be split and welded to fix it in place, as indicated at 20. The refractory may have a second circumferential groove in its outside face below grooves 18, and the band may have a crimp received in the second groove to hold it against relative axial movement, especially when it expands as it is heated by proximity to liquid metal. The band has diametrically opposed slots mating with grooves 18 and receiving clip 17. The presence of the band overcomes the need to rely on grooves 18 in the refractory being properly located to orient the outlets 12, since the slots in the band now receive the clip. Consequently grooves 18 can be formed as a single groove encircling the refractory, or if the band is sufficiently thick, grooves 18 can be eliminated altogether, and the clip received solely in slots in the band. Orientation of the tube of course is immaterial if the outlet is in the bottom of the tube.

FIGS. 3 and 4 show a modified construction of pouring tube illustrated as having an open lower end 24. The lower edge of the band 19a is bent to form a flange 25 which is received in a groove 21a in the outside face of the refractory. The band is held in place by a tie 26 which may be formed of steel strapping, wire, a metal clip or the like. The band may be formed in one piece with a single split, or in two or more segments with a corresponding number of splits. Of course the form of band shown in either embodiment may be used with tubes having either form of outlet.

From the foregoing description it is seen that my invention affords a simple means for strengthening a pouring tube in its weakened region where it is attached to a holder with a clip. The band distributes the load around the circumference of the refractory. In actual usage, I have observed tubes which lack the band often breaking at the groove. Addition of the band has effectively prevented such breakage.

I claim:

1. In a combination which includes a holder, a pouring tube, and means attaching said tube to said holder,

said holder comprising a refractory block, a metal frame around at least a portion of said block, and a skirt depending from said frame; said tube being formed of refractory, the upper end portion of which is received in said skirt; said attaching means comprising clip means extending through said skirt and engaging said tube; the improvement comprising: a metal band encircling the refractory of said tube and having opposed slots receiving said clip means; and means fixing said band to said refractory.

2. An improvement as defined in claim 1 in which

said refractory has circumferential grooves under the slots in said band.

3. An improvement as defined in claim 1 in which said band is split and welded at the split, and said refractory has a circumferential groove and said band is crimped to engage said groove.

4. An improvement as defined in claim 1 in which said band is split and held in a tie, and said refractory has a circumferential groove, and said band is flanged at its lower edge to engage said groove.

5. A combination as defined in claim 1 in which said clip means is a U-shaped clip.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,845,943 Dated November 5, 1974

Inventor(s) James T. Shapland

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet insert -- [73] Assignee: United States Steel Corporation --.

Signed and sealed this 21st day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents