March 6, 1956 J. A. SHEA 2,736,935

STOPPER ROD WITH SOLID HEAD

Filed March 11, 1953

FIG. 2.

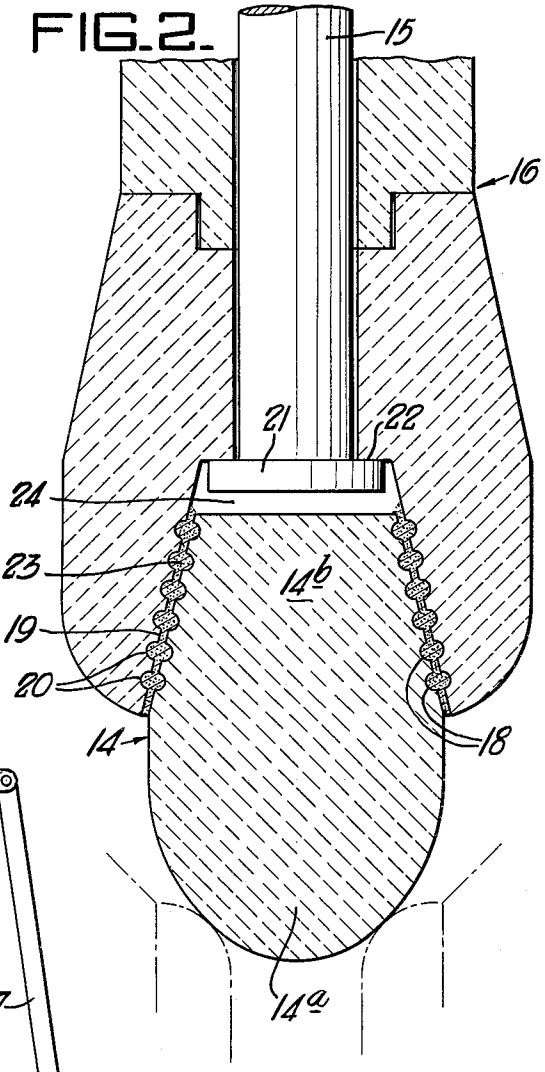


FIG. 1.

Inventor:
JAMES A. SHEA,
by: Donald G. Dalton
his Attorney.

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STOPPER ROD WITH SOLID HEAD

James A. Shea, Gary, Ind., assignor to United States Steel Corporation, a corporation of New Jersey

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1 Claim. (Cl. 22—85)

This invention relates to improvements in stoppers for bottom pour ladles.

Molten metal, such as steel tapped from open hearth furnaces, often is handled in a refractory lined ladle which has a pouring nozzle in its bottom wall. A stopper, which depends from the top of the ladle and has external operating mechanism, controls flow of metal through this nozzle. The usual stopper includes a vertical steel rod, a series of refractory sleeves around the rod, and a refractory head below the lowermost sleeve. The nozzle is of refractory clay and the parts of the head exposed to flowing metal are of a clay-graphite composition (about 15% graphite).

In previous stoppers with which I am familiar, it has been customary to support the stopper head from the stopper rod. Some stoppers include a steel stopper head pin engaged at its opposite ends with the stopper head and the stopper rod. In others the head is connected directly to the rod, as by a threaded joint. In many arrangements the graphite of the head is in direct contact with the steel of the stopper head pin or of the stopper rod and thus acts to carburize the steel and contributes to its failure. In other arrangements the steel head pin or stopper rod is insulated from the graphite head to overcome this difficulty, but the mechanical connection between the stopper head pin and the stopper head remains to weaken the latter. In ladles used for teeming metal into ingot molds, the life of a stopper head is barely sufficient to teem one ladle, and serious damage can result when a head fails before the ladle is empty. Consequently any means for prolonging stopper head life is highly important.

An object of the present invention is to provide an improved stopper in which the head has no contact with metal parts and is free of mechanical connection with any head pin such as would tend to weaken it.

A more specific object is to provide a stopper in which the head is a solid body attached by cementing to the lowermost refractory sleeve so that it is not weakened by passageways for receiving a mechanical connector.

In accomplishing these and other objects of the invention, I have provided improved details of structure, a preferred form of which is shown in the accompanying drawing, in which:

Figure 1 is a vertical sectional view of a ladle and stopper constructed in accordance with my invention; and

Figure 2 is a vertical sectional view on a larger scale of the head portion of the stopper.

Figure 1 shows a portion of a typical ladle which comprises an outer shell **10** and a lining **12** of refractory brickwork. The ladle has a pouring nozzle **13** and a stopper which includes a head **14**, a rod **15**, a series of refractory sleeves **16** and an operating mechanism **17**. In accordance with the usual practice, the parts of the stopper head exposed to flowing metal are of a

graphite composition which may become eroded but does not plastically deform. The nozzle is plastic at the temperatures encountered and tends to form to the contour of the hard stopper head to furnish a tight seal as the stopper is placed into the mouth of the nozzle. Inasmuch as the foregoing parts, aside from the stopper head **14** and the lowermost sleeve **16**, can be of any standard or desired construction, no more detailed description is deemed necessary.

Figure 2 shows the novel head **14** on a larger scale. The head is a solid bulb-shaped body unbroken by passageways for receiving a mechanical connector. It includes a rounded lower portion **14***a*, whose shape is approximately hemispherical, and a frusto-conical upper portion **14***b*. Preferably the conical surface of the latter portion has a series of circumferential grooves **18**. The lowermost refractory sleeve **16** contains a flared counterbore **19** whose surface also preferably has circumferential grooves **20**. The lower end of the rod **15** carries a flange **21** and the lowermost sleeve has a shoulder **22** which is located at the top of its counterbore **19** and rests on said flange. The frusto-conical portion **14***b* of the head fits within the flared counterbore **19** and is retained therein by a layer of refractory cement **23** which fills the grooves **18** and **20**. The upper face of the head is insulated from the bottom face of the flange **21** of the rod preferably by an air gap **24** so that the graphite head cannot act to carburize the rod.

From the foregoing description it is seen that the present invention provides a stopper head free of contact with metallic parts which can be carburized and having no interior passageways which tend to weaken it mechanically. Consequently its life is prolonged over other stopper heads which lack these advantages.

While I have shown and described only a single embodiment of the invention, it is apparent that modifications may arise. Therefore I do not wish to be limited to the disclosure set forth but only by the scope of the appended claim.

I claim:

A stopper for bottom pour ladles comprising a metal rod terminating in a flange at its lower end, a series of refractory sleeves surrounding said rod, the lowermost of said sleeves having a flared counterbore in its lower end and a shoulder at the top of said counterbore resting on said flange, a solid head of a clay-graphite composition having a rounded lower portion adapted to cooperate with a nozzle and a frusto-conical upper portion received in said counterbore, the conical surface of said head and the flared surface of said counterbore having circumferential grooves, and a layer of refractory cement between conical surface and said flared surface filling said grooves and attaching said head to said lowermost sleeve, said head being spaced below said flange and being free of contact with metal, said layer of cement furnishing the sole support for said head.

References Cited in the file of this patent

UNITED STATES PATENTS

1,303,324	Jackson	May 13, 1919
1,825,177	Brosius et al.	Sept. 29, 1931
2,195,791	Slick	Apr. 2, 1940
2,248,941	Bidner et al.	July 15, 1941
2,296,059	Sage	Sept. 15, 1942

OTHER REFERENCES

Pages 150 to 153, inclusive, Open Hearth Proceedings, Iron and Steel Div., A. I. M. E., Room 905, 29 West 39th St., New York 18, New York, vol. 28, 1945.