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NOZZLE FOR MOLTEN METAL CONTAINERS

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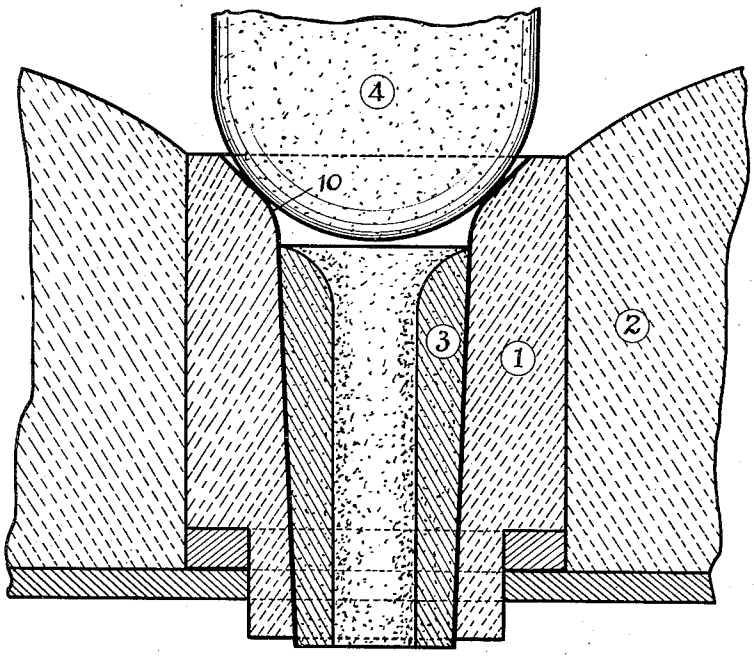

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UNITED STATES PATENT OFFICE

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NOZZLE FOR MOLTEN-METAL CONTAINERS

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This invention relates to improvements in nozzles for molten-metal containers, and finds practical application in a nozzle for a ladle in which molten steel is carried and from which molten steel is poured into a mold. The object in view is cheapness and utility, combined in larger degree than hitherto has been known.

The accompanying drawing is a view in vertical and medial section of a nozzle embodying my invention, in place in the bottom of a steel ladle.

In the casting of ingots and other articles, steel is introduced in molten condition into a ladle, in the bottom of which a nozzle is set. The nozzle is normally closed by a stopper. The ladle with its charge of molten steel is brought to position over the ingot mold or other mold, and when in position the stopper is raised, and molten steel then flows through in a stream into the mold. Replacement of the stopper at proper time cuts off the flow.

The nozzle is essentially a tube set in an orifice in the bottom of the ladle formed to receive it; the stopper is essentially a plug arranged within the ladle and movable vertically above the upper end of the tubular nozzle, alternately to close the tube and cut off flow and to leave the tube open to the flow of molten metal.

Nozzles and stoppers hitherto have commonly been made either of fire clay or of graphite. Of these materials, fire clay is the cheaper and graphite is the more refractory. Because of the fact that, at the great temperature of service, graphite keeps its shape and is not so easily scored and worn by the flowing stream of metal, and because of the consequent fact that the stream delivered through an orifice in a graphite body is less disturbed by irregularities consequent upon wear, it is desirable that these parts be made of graphite, but in case nozzle and stopper be formed of graphite, a difficulty arises, in that at the high temperature of service the graphite stopper adheres to the graphite nozzle and the operation of pouring is on that account embarrassed. And, as has been said, these parts, if made of graphite, are relatively costly.

My invention is found in a nozzle of fire clay, lined with a bushing of graphite. These components are so arranged and proportioned that the bushing is secure in its place; the flow of the stream of metal is free; and the stopper makes contact with the nozzle, not upon a graphite surface, but upon a fire-clay surface. The body of fire clay under the temperature of service becomes relatively soft and the stopper, which in that portion at least which makes contact with the body of the nozzle is of graphite, so far shapes the body of clay as to make tight closure; and yet there is no such adhesion of the graphite of the stopper to the clay of the nozzle as to embarrass operation.

Referring to the drawing the nozzle 1 is shown in place in an orifice in the bottom of the ladle 2. The nozzle is essentially of tubular form, so minutely shaped as to be seated from above and to rest securely in place in the orifice formed to receive it. The nozzle consists of a body of fire clay, to which the numeral 1 is immediately applied, and of a bushing of graphite 3 arranged in place within it. It will be observed that the bore of the tubular body 1 tapers downwardly and that the bushing 3, exteriorly, tapers correspondingly, to the end that the bushing, inserted from above, rests securely in the fire-clay body. The tubular bushing 3 extends preferably to the lower end of the body of the nozzle, but when in place it rests below the upper end of the fire-clay body. Above the upper rim of the bushing 3, the fire-clay body of the nozzle presents an annular surface, preferably a bulging surface 10, upon which the stopper 4 is seated. The stopper does not, in normal operation, make contact with the graphite bushing 3, but with the fire-clay body 1. The stopper 4, or at least its lower end, is formed of graphite, and the body of graphite 4 engaging the seat 10 of the fire-clay body 1, affords the desired security of closure, without embarrassing adhesion.

There are incidental advantages. Not only is the compound nozzle more durable,

and more serviceable, than a nozzle formed of clay; not only is it cheaper than a nozzle formed wholly of graphite; but it has the added characteristic that the bushing 3, being removable, is replaceable; and this is a characteristic which will in service be found to be of advantage. Particularly, choice may be made between bushings 3 of different internal diameter, and the nozzle may be readily adapted (as otherwise it could not be) to conditions of the molten metal—conditions which may not be anticipated, and cannot until the last minute be known.

I claim as my invention:

1. A compound nozzle for molten metals comprising a perforate supporting body of a less refractory material, such as fireclay, which in its upper portion contains the seat for the stopper, and a supported bushing of a more refractory material, such as graphite. extending within such perforation from directly below the seat for the stopper to the outlet.

2. A compound nozzle for molten metal comprising a supporting body made of a less refractory material, such as fireclay, which forms the seat for the stopper and has underneath said seat a tapered perforation, and, within such perforation extending for its entire length and completely surrounded and insulated by the clay body, a correspondingly tapered bushing made of a highly refractory material, such as graphite.

In testimony whereof I have hereunto set my hand.

CLYDE H. MILNER.