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NOZZLE FOR METALLURGICAL EQUIPMENT

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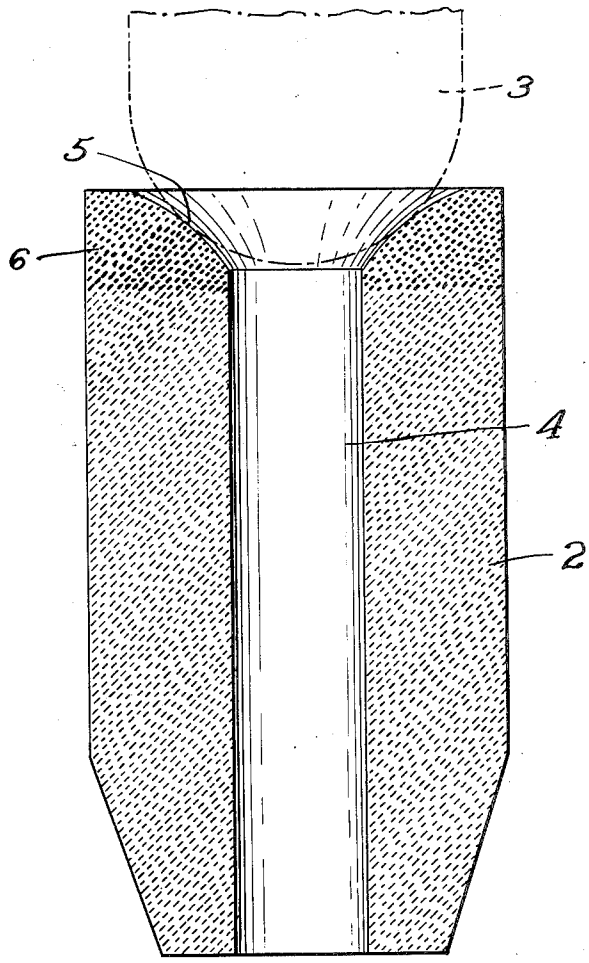


Fig. 1.

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NOZZLE FOR METALLURGICAL EQUIPMENT

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2 Claims. (Cl. 22—85)

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This invention relates to nozzles of the type used in metallurgical equipment such as ladles and the like, through which molten metal is discharged from the bottom of the receptacle.

Nozzles of the kind to which the present invention pertain are commonly provided in the bottom of metallurgical ladles and other equipment into which molten metal is charged. The ladle or other equipment is commonly provided with a vertically movable plug or stopper that is raised and lowered over the upper end of the nozzle for controlling the discharge of molten metal therethrough.

Considerable difficulty is sometimes encountered during a pour in operating the plug to close off the flow of metal at the proper time. This is occasioned by failure of the plug to conform to the seat provided for it in the upper end of the nozzle. It has heretofore been proposed to remedy this condition by forming the nozzle in two separate parts, one of which is designed to provide a better seat for the plug, but these generally have not been satisfactory, due principally to the cost and difficulty of making them, and due to the separation of the parts which occurred in their use.

The present invention has for its object to overcome this difficulty by providing a single piece nozzle in which the upper seat-forming end is of slightly softer character at operating temperatures than the remainder of the nozzle. This softer part, when exposed to the molten metal in the ladle, will yield and conform to the plug when the plug is forced down against it to thereby cut off the flow of metal through the nozzle.

My invention may be more fully understood by reference to the accompanying drawing, which illustrates a vertical section through a nozzle constructed in accordance with my invention, and wherein the cooperating plug is indicated in dotted lines.

In the drawing, 2 designates a single-piece nozzle, and 3 shows the lower portion of the plug in dotted lines, the plug being shown seated on top of the nozzle or spout. The associated parts of the ladle or other metallurgical apparatus in which the nozzle is used are not illustrated, these being of conventional form.

The nozzle 2 is normally provided with a tapered lower end, and with a passageway 4 extending axially throughout its length. At the upper end of the body the passageway 4 flares outwardly providing a seating surface 5.

The single piece body 2 has the first few inches

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of the upper portion formed of refractory which is softer under operating conditions than the remaining part of the nozzle. This condition may be brought about in various ways. The nozzles are usually formed of clay, and the upper part of the body, in the region designated 6, including the part that carries the seat 5, is formed of a clay that has a slightly lower softening temperature or melting point. For example the main body of the nozzle 2 may soften at a temperature of around 3000° F., while the top clay will soften at around 2700° F. The figures here given are only by way of example, and the difference may be selected to a greater or lesser extent as the user may desire. Refractory clays, having such differences in softening points, are well known in the art.

The nozzle is formed in this case in a mold as is the usual practice, by first forming the body 2 from the "hard" clay and then the upper part of the mold is charged with the "softer" clay to form the portion 6. The two bodies of clay bond together in the forming operation, and constitute an integral one-piece body when the entire nozzle is fired.

In lieu of using clay of two different kinds, clay of the same kind may be used but a flux may be incorporated into the clay, constituting the upper part 6 of the body, in which case the same result is obtained.

Also, the body may be formed in one piece from a clay of uniform composition throughout. It is fired in the usual way. Then the body is placed with the upper end down, in a vessel containing a solution of a salt or other compound to a depth of a few inches. The depth of the solution depends upon the vertical height of the part 6 of the nozzle. The solution will be soaked into the part of the nozzle which is immersed in it. After the body has stood in the solution for a desired length of time, preferably for at least several hours, it is taken out and allowed to dry. Upon evaporation of moisture, the salt compound which was in the solution will be distributed in situ throughout the immersed portion of the nozzle.

The compound which is employed in solution is one which will act as a flux to cause the clay upon being heated to soften below the temperature at which the remainder of the body will soften or cause it to "bloat." Various compounds may be used for this purpose, but common salt (NaCl) is quite satisfactory and economical. Another compound of the same character which may be used in solution is soda ash. These are

merely typical of various compounds that may be employed, and which are well known to ceramic engineers, and which will function to make the clay in the upper end of the nozzle softer under the conditions of use of the nozzle than the remaining part of the nozzle.

The softer material provides in effect a valve seat which will easily accommodate itself under the conditions of use to the seating of the valve or plug 3. The remainder of the body however, being harder, will more effectively resist erosion. Hence my invention provides a pouring nozzle for ladles or the like formed of one piece and having the upper end of a refractory which is softer under conditions of use in the ladle than the remaining part of the nozzle. Being in one piece, the nozzle has good mechanical strength, and is simple to manufacture. By forming the nozzle entirely of one body of clay of uniform softening point, firing it and then impregnating it with a flux, the nozzle is especially strong and cheap to manufacture, in that it is unnecessary during the manufacture or molding the nozzle to change from one type of clay to another. Also the body is stronger because it is fired before the fluxing compound is impregnated into it, and hence the entire body is fired to the same extent when the article is burned in the kiln, and there is less likelihood of damage to the nozzle in being fired.

If the entire body were formed of the softer clay, it would erode more rapidly, and more of the clay would be carried away by the metal being poured. Any clay so carried away contaminates the metal. By having a one-piece nozzle in which only the upper part is of the softer material, the amount of the softer clay which contacts the molten metal is relatively little and the contamination is only a small percentage of that which would occur if the entire nozzle were made of the softer clay.

While I have shown and described one specific form of nozzle, it will be understood that my invention is applicable to nozzles of different forms and shapes.

I claim:

1. The method of making a nozzle for metallurgical apparatus, which nozzle comprises a one-piece refractory body having a central opening therethrough and having a seat portion at the top thereof around said central opening, which comprises shaping the body from a refractory mass of uniform composition, firing the body, immersing the upper end of said body only in a solution carrying a fluxing compound, and removing the body from the solution and evaporating the solvent whereby to deposit in the immersed portion of the body the flux.

2. A nozzle for metallurgical apparatus comprising a one-piece body having an axial opening therethrough and a seat-forming portion for cooperation with a valve plug at its upper end which is softer at the temperatures and under the conditions in which the nozzle is used than the remaining portion of the body, said body being a fired refractory clay body of uniform composition throughout and having its said upper end impregnated with a fluxing salt by immersing said upper end only in a solution of the salt to thereby lower the softening temperature of said upper end as compared to said lower end.

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