

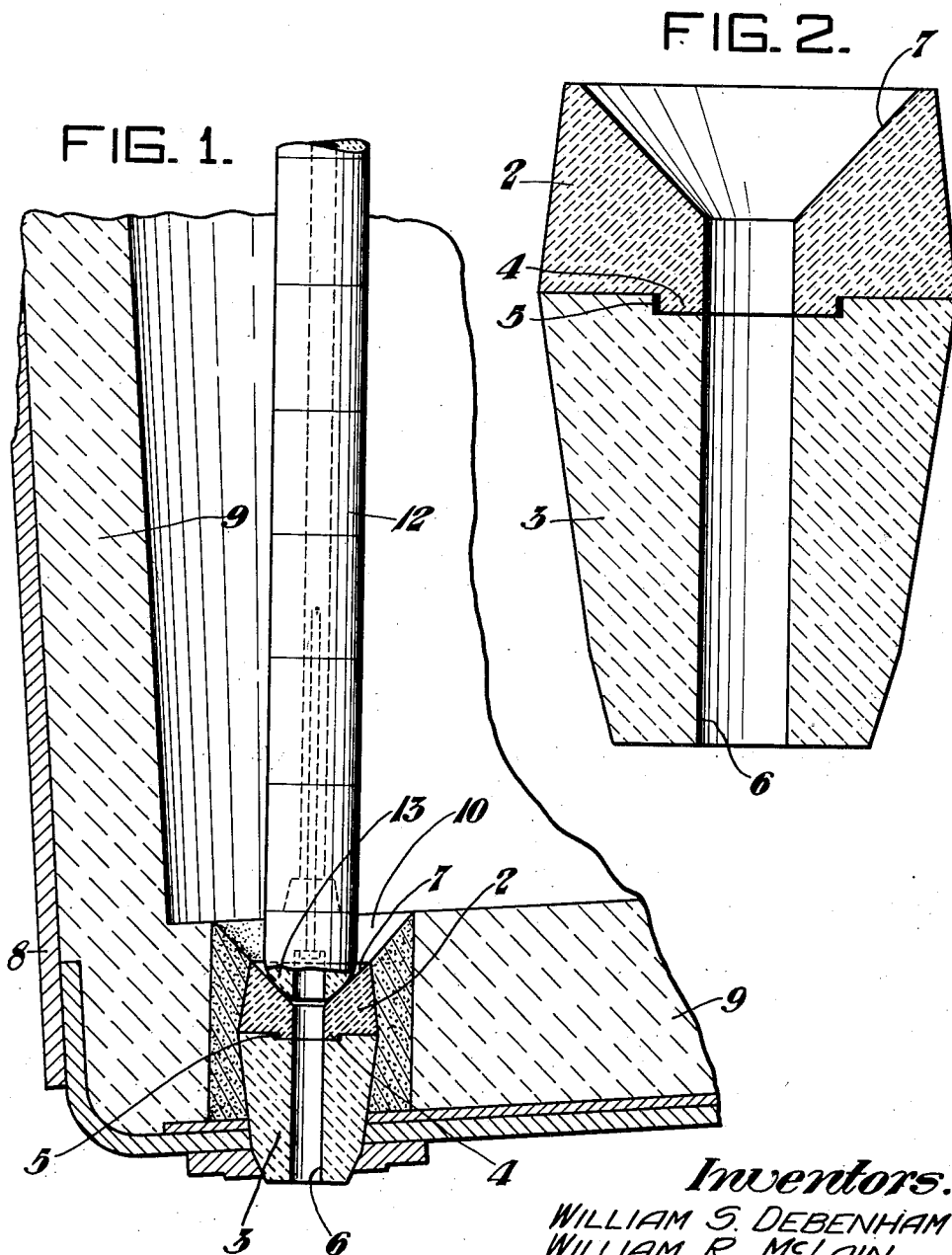
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REFRACTORY NOZZLE

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REFRACTORY NOZZLE

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This invention relates to a refractory nozzle and particularly to an improved refractory nozzle for use in pouring or teeming molten metal.

Refractory nozzles of the type now generally incorporated in ladles and the like for pouring or teeming molten metals therefrom having an extremely high melting temperature; namely, above 2000 degrees Fahrenheit, should inherently have two distinct characteristics to be most efficient, that is, the topmost or inner portion of the nozzle should possess the inherent characteristic of becoming relatively soft so as to provide an effective seal at the point where the head of the stopper rod contacts the nozzle so as to prevent leakage of the molten metal at this point, and the lowermost or outer portion of the nozzle should possess the inherent characteristic of remaining hard and not becoming soft when the hot molten metal is being poured therethrough so as to resist erosion of the passageway through the nozzle by the molten metal during teeming.

Such nozzles heretofore were usually of a unitary construction and it was practically impossible to provide a unitary nozzle having both of the above mentioned properties. That is, it would be impractical as well as difficult to provide such a nozzle having the topmost or inner portion of a low degree of refractoriness and the lowermost outer portion thereof of a high degree of refractoriness, and one of these characteristics, of course, would have to be sacrificed at the expense of the other.

In the present invention, a two-piece refractory nozzle has been provided, thereby permitting the incorporation of both of these desirable features therein and eliminating the disadvantages and difficulties attendant to the production of such a nozzle in a single integral piece.

Accordingly, it is one of the objects of the present invention to provide an improved refractory nozzle having all the characteristics that such a nozzle should possess.

It is another object of the invention to provide a refractory nozzle consisting of a plurality of parts which is simple and inexpensive in its construction and, yet, one which is strong and rugged, and most effective in its use.

Various other objects and advantages of this invention will become more apparent in the course of the following specification and will be particularly pointed out in the appended claims.

In the accompanying drawing there is shown, for the purpose of illustration and description, one embodiment which our invention may assume in practice.

In the drawing:

Figure 1 is a vertical section through a ladle showing the improved refractory nozzle of our invention incorporated therein; and

Figure 2 is an enlarged longitudinal section through the nozzle.

Referring more particularly to the drawing, the improved refractory nozzle of the present invention, as shown in Figure 1, comprises an upper or inner part 2 and a lower or outer part 3. These two parts are interengaged with each other preferably by means of an annular flange 4 arranged on the bottom side of the upper part 2 which is adapted to cooperate with a correspondingly shaped annular recess 5 arranged in the top of the lower part 3. It will be understood that any other means may be provided for interengaging these parts, such as a tongue and groove arrangement, or any other interlocking arrangement whereby the parts are held in engagement and alignment with each other. There is axially disposed through the two parts of the nozzle 2 and 3, a passageway 6 through which the molten metal is adapted to flow. There is arranged in the top side of the upper nozzle 2 preferably a conical or semi-spherical shaped recess 7 in which means for stopping the flow of a molten metal through the nozzle is adapted to seat.

Such refractory nozzles are mostly used in connection with large ladles for delivering the molten metal therefrom, as shown in Figure 1 of the drawing. The portion of the ladle, as shown in Figure 1, consists of a steel shell 8 having an inner refractory lining 9. The refractory nozzle is suitably positioned in an opening 10 arranged in the bottom of the ladle in any convenient manner. Usually such ladles employ a stopper rod 12 having a stopper head 13 arranged on the lower end thereof which is adapted to cooperate in one position with the upper end of the passageway through the nozzle to prevent the flow of the molten metal therethrough and adapted to be moved to another position to permit the flow of the metal therethrough.

According to the present invention, the upper part of section 2 of the nozzle has a low degree of refractoriness having preferably a softening point or pyrometric cone equivalent between cone 12 and cone 27 and possibly for better results between cone 16 and cone 23. A refractory material of the following mixture has been found very practical for obtaining an upper nozzle part or section having the proper softening characteristics. Such a mixture consists of approximately 27 per cent by weight of Al_2O_3 , approximately 64

per cent by weight of SiO_2 and approximately a 9 per cent flux content consisting preferably of Fe_2O_3 , Na_2O , K_2O , TiO_2 , CaO and MgO .

The lower part or section 3 of the nozzle has a high degree of refractoriness having preferably a softening point or pyrometric cone equivalent not less than cone 26 or, possibly for better results, not less than cone 30. A refractory material of the following mixture has been found very practical to obtain the desired degree of refractoriness for this section. Such refractory material consists of a mixture of approximately 40 per cent by weight of Al_2O_3 , approximately 53 per cent by weight of SiO_2 and approximately a 7 per cent flux content consisting preferably of Fe_2O_3 , Na_2O , K_2O , TiO_2 , CaO and MgO .

It will be understood that the refractory properties or characteristics of both parts or sections 2 and 3 can be varied as desired by varying the flux content or the alumina-silica ratio. For example, in the upper part 2, the range of cone 12 to cone 27 can be obtained either by varying the flux content between about 5 per cent for cone 27 to about 12 per cent for cone 12, or by varying the alumina-silica molecular ratio between one to three for cone 27 and from one to seven for cone 12.

In the lower part or section 3, the minimum softening point of cone 26 may be obtained by means of a mixture showing an analysis, that is, alumina-silica molecular ratio and flux content, substantially the same as that for cone 27 as has already been indicated for the upper part 2. It will be understood that the more the refractoriness of the material or clay, the greater will be the ratio of alumina to silica, or the flux content thereof will be lower or both.

Natural clays possessing the desired refractoriness should be used if available in preference to attempting to mix or adulterate clays to obtain the desired refractoriness, because of the difficulties involved in obtaining uniform mixtures.

While alumina-silica minerals have been indicated in the above examples and throughout the description, it will be understood that other refractory materials, such as clay-graphite mixtures, chrome, magnesite, dolomite, forsterite or diaspore, or any other suitable minerals, may be used as long as the desired refractoriness is obtained in the respective parts or sections. However, fire clays are most practical for use because they are inexpensive, and a fire clay containing the desired properties can be found by proper selection.

While we have shown and described one embodiment of our invention, it will be understood that this embodiment is merely for the purpose of illustration and description and that various other forms may be devised within the scope of our invention, as defined in the appended claims.

We claim:

1. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay comprising a mixture of approximately one part by weight of alumina, approximately from two to seven parts by weight of silica, and approximately from 5 to 12 per cent by weight of a flux, so that said inner part has a pyrometric cone equivalent of approximately from cone 16 to 23 whereby the same has a relatively low degree of refractoriness and possesses the inher-

ent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at this point, and the outer part of said nozzle consisting of a fireclay comprising a mixture of approximately one part by weight of alumina, approximately one and one-half parts by weight of silica, and approximately 5 to 7 per cent by weight of a flux, so that said outer part has a pyrometric cone equivalent of not less than approximately cone 26 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

2. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay comprising a mixture of approximately one part by weight of alumina, approximately from two to seven parts by weight of silica, and approximately from 5 to 12 per cent by weight of a flux, so that said inner part has a pyrometric cone equivalent of approximately from cone 12 to 27 whereby the same has a relatively low degree of refractoriness and possesses the inherent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at this point, and the outer part of said nozzle consisting of a fireclay having a pyrometric cone equivalent of not less than approximately cone 30 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

3. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay having a pyrometric cone equivalent of approximately from cone 16 to 23 whereby the same has a relatively low degree of refractoriness and possesses the inherent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at this point, and the outer part of said nozzle consisting of a fireclay comprising a mixture of approximately one part by weight of alumina, approximately one and one-half parts by weight of silica, and approximately 5 to 7 per cent by weight of a flux, so that said outer part has a pyrometric cone equivalent of not less than approximately cone 26 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

4. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay comprising a mixture of approximately 27 per cent by weight of alumina,

approximately 64 per cent by weight of silica, and approximately 9 per cent by weight of a flux, so that said inner part has a pyrometric cone equivalent of approximately from cone 16 to 23 whereby the same has a relatively low degree of refractoriness and possesses the inherent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at this point, and the outer part of said nozzle consisting of a fireclay having a pyrometric cone equivalent of not less than approximately cone 26 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

5. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay comprising a mixture of approximately 27 per cent by weight of alumina, approximately 64 per cent by weight of silica, and approximately 9 per cent by weight of a flux, so that said inner part has a pyrometric cone equivalent of approximately from cone 16 to 23 whereby the same has a relatively low degree of refractoriness and possesses the inherent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at this point, and the outer part of said nozzle consisting of a fireclay comprising a mixture of approximately 40 per cent

by weight of alumina, approximately 53 per cent by weight of silica, and approximately 7 percent by weight of a flux, so that said outer part has a pyrometric cone equivalent of not less than approximately cone 26 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

6. A refractory pouring nozzle for use in ladles and the like comprising two interengaging parts, the inner part of said nozzle consisting of a fireclay having a pyrometric cone equivalent of approximately from cone 12 to 27 whereby the same has a relatively low degree of refractoriness and possesses the inherent characteristic of becoming relatively soft when molten metal comes in contact therewith so as to provide an effective seal at the point where the stopper rod of the ladle contacts the nozzle thereby preventing leakage of the molten metal at the point, and the outer part of said nozzle consisting of a fireclay comprising a mixture of approximately 40 per cent by weight of alumina, approximately 53 per cent by weight of silica, and approximately 7 per cent by weight of a flux, so that said outer part has a pyrometric cone equivalent of not less than approximately cone 30 whereby the same has a relatively high degree of refractoriness and possesses the inherent characteristic of remaining hard when the molten metal passes therethrough so as to prevent erosion of the passageway through the nozzle by the molten metal.

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