

United States Patent

[11] 3,540,627

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[56]	References Cited		
	UNITED STATES PATENTS		
500,386	6/1893	Hartman	266/42
2,005,311	6/1935	Belding	222/559
3,124,854	3/1964	Dore	222/559X
3,398,945	8/1968	Walpole	266/42

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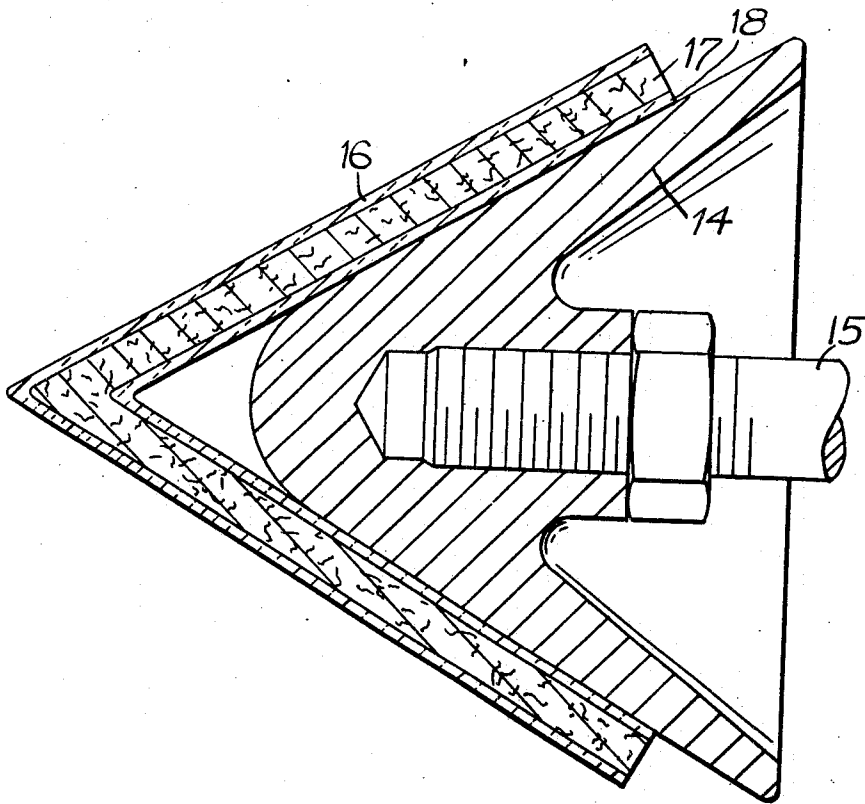
[54] DRAIN SEAL FOR METAL RECEPTACLES
3 Claims, 3 Drawing Figs.

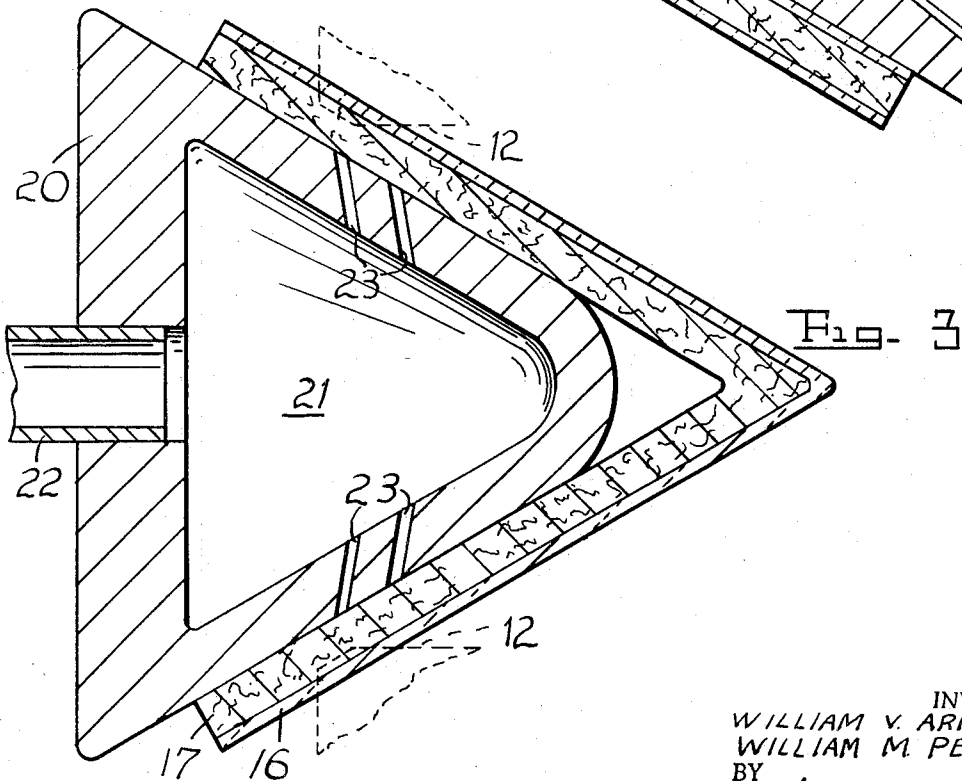
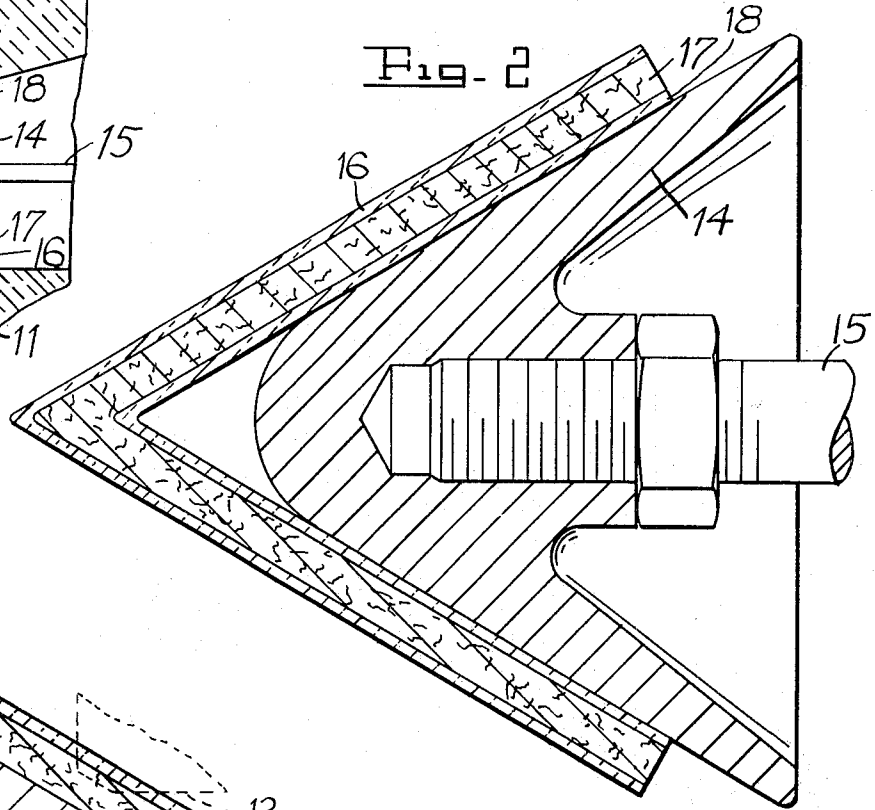
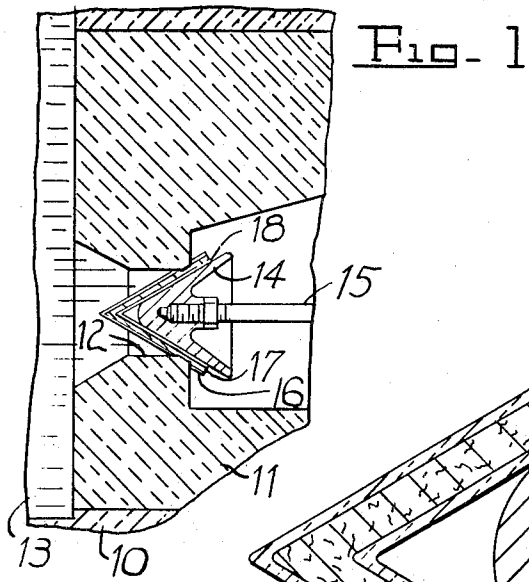
[52] **U.S. Cl.**..... 222/146,
222/542, 222/563, 266/42

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C21b 7/12

[50] **Field of Search**..... 222/559,
563, 146, 542, 266/42

ABSTRACT: An apparatus for sealing the flow of metal from a molten metal receptacle using a conical plug fitted within a complementary orifice of a tapping block. A resilient refractory fiber pad covers the plug and a mat of grass fiber is interposed between the plug and the pad to provide economical backing for the relatively expensive pad. In one embodiment, the plug is hollow and cooling air is provided about the line of contact between the plug and orifice.





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DRAIN SEAL FOR METAL RECEPTACLES**BACKGROUND OF THE INVENTION**

In the handling of molten metal, such as aluminum, it is a common practice to utilize molten metal receptacles such as open hearths or various types of furnaces provided with replaceable tapping blocks having a cylindrical orifice. During transfer of molten metal from the receptacle, the metal passes through this orifice, and during heating operations, the orifice is maintained in a closed condition by means of a conical plug. For many years, such conical plugs were coated with material such as a mixture of flour and water, known as "dough" and the sealing of the orifice by this means was generally referred to as "doughballing".

Recent developments have led to substantial use of replaceable conical pads of resilient refractory metal to coat the conical surfaces of the plug. An example of such usage is described and illustrated in U.S. Pat. No. 3,124,854, titled "Refractory Stopper for Aluminum Casting Apparatus and Method of Casting". According to that patent, a resilient refractory material is used to cover the plug in the area of contact between the plug and the orifice. The type of refractory material disclosed is stated to be of primary importance, and the best suited material is stated to be aluminum silicate fiber materials such as the material sold under the trade name of "Fiberfrax".

One difficulty with the use of such refractory materials as covers for the plug is the expense of using these specialized materials as expendable covers which can only be used in contact with the very hot molten metal while they remain physically intact. In some situations, it has become common to use many layers of the conical covers to provide adequate resiliency so that the plug can effectively seal about the periphery of the orifice and accommodate variations in the orifice configuration. The use of the refractory material is expensive and the cost of multiple layers eventually becomes prohibitive. Accordingly, the basic concepts disclosed herein are designed to minimize the expense of using such refractory pads and to minimize overheating and deterioration of the pads.

SUMMARY OF THE INVENTION

According to this disclosure, an intermediate glass fiber mat is interposed between the pad of resilient refractory material and the conical plug in the area of contact between the plug and orifice. The relative inexpensive glass fiber mat provides the added resiliency in the covering assembly and minimizes the expense of the total assembly. It also provides improved insulation to the pad surfaces so that the metal at the orifice does not tend to cool and seal the orifice. Under current practice the metal after "freezing" at the tapping block, cannot be removed without burning through the orifice opening. This frequently leads to damage of the block.

Besides the use of the glass fiber mat, there is an additional alternative claimed herein which involves the provision of cooling air provided in the plug through the mat surfaces at the contact area about the orifice. This protects the mat and outer pad from overheating, while maintaining the major portion of the orifice in the desired insulated condition. Slight cooling or freezing of the metal about the edges of the orifice do not detract from the ability of the orifice to provide the required flow of metal when the plug has been removed.

It is a first object of this invention to provide an economical assembly for covering the conical plug used to selectively stop the orifice of a molten metal receptacle, by utilizing common insulating material readily available today.

Another object of the invention is to provide an improved covering assembly for the conical plug which will eliminate the tendency of the molten metal at the orifice to "freeze" or harden prior to removal of the plug.

Another object of the invention is to provide an improved apparatus for cooling the critical portions of the covering assembly so as to extend their normally useful life.

These and further objects will become more evident in connection with the following disclosure and the accompanying drawings. It is to be understood that the structure shown in the drawings is presented only by way of illustration and that the present disclosure is not to be limited specifically to the precise features shown.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view taken through a tapping block of a molten metal receptacle, showing the present apparatus in actual use;

FIG. 2 is an enlarged sectional view through the center of a typical plug, showing the covering apparatus in detail; and

FIG. 3 is another sectional view through a modified plug and covering apparatus, with the outline of the orifice periphery at the top and bottom of the view being illustrated in dashed lines.

PREFERRED EMBODIMENT OF THE INVENTION

The structure to which the disclosure relates is well shown in the prior art, particularly in U.S. Pat. No. 3,124,854. Therefore, the present disclosure will not go into detail with respect to the apparatus for holding the plug in place nor the apparatus by which the tapping block is held in the receptacle. The present disclosure is readily applicable to any conventional structure used for these basic purposes.

As shown, there is illustrated a portion of a molten metal receptacle 10 having an inserted tapping block 11 including a cylindrical orifice at 12. The molten metal within receptacle 10 is shown generally at 13 and the orifice 12 is used to permit the flow of metal from the interior of the receptacle 10 when required. A conical plug 14 is selectively held within orifice 12 by a supporting rod 15 and associated mechanisms for holding it in place or permitting its removal when required. The plug 14 is substantially conical, meaning that it has the shape of a dome, a frustum of a cone or a cone with a rounded apex. The plug obviously can be of a shape other than conical, so long as the configuration of the contacting portions of the plug and orifice 12 are such that a line of contact may be made between the outer peripheral surface of the plug and the inner periphery of the orifice.

As shown in FIG. 2, the outer layer of the assembly used to cover plug 14 is a conical pad 16 made of a resilient refractory material such as "Fiberfrax" as described in U.S. Pat. No. 3,124,854. Other resilient materials sold under different brand names can be substituted. One that is particularly useful is "Cerafelt" manufactured by the Johns-Manville Company. Also very suitable is a layer of asbestos, made in a cone from 010 asbestos sheeting, having a thickness of approximately one-thirty-second of an inch.

To provide resiliency and insulating properties to the plug assembly, we utilize an intermediate layer 17 of insulating glass fiber, preferably about one-half inch in thickness. The layer 17 is a relatively high density mat of glass fibers or glass wool. A suitable product is sold under the trade name "Aircore" in one-half inch thick sheets by Owens-Corning. As shown in FIG. 2, an inner pad 18 of refractory material is provided between the plug 14 and the layers 17, but this can be eliminated if desired. The layers 16 and 18 are preferably of identical materials, although they might differ so long as they are chosen from the basic group of resilient refractory materials suitable for such application.

By utilizing the intermediate layer 17 of an insulating mat of glass material, we provide greater insulating characteristics to the covering assembly than can be accomplished by use of the refractory material alone. When using multiple cones of the refractory material, the metal sometimes freezes at orifice 12 due to the conduction of heat through the conical plug 14. This generally requires the metal to be burned at the orifice and ruins the orifice, which is relatively expensive to replace. By use of the insulating layers 17, the metal at the orifice remains heated and does not freeze. Furthermore, the 1/2-inch

mat provides additional resiliency to the assembly to accommodate variations in the orifice configuration and to securely seal orifice 12 abuts its entire periphery.

FIG. 3 illustrates a modification of the structure. In this modification, the plug 20 has the general exterior configuration shown in FIGS. 1 and 2, but is formed with an interior hollow cavity at 21. The cavity 21 is in open communication with a hollow mounting rod 22 through which compressed air can be supplied to cavity 21. A series of radial openings 23 are provided through the conical shell of the plug 20, being directed generally to the area of the plug exterior adjacent to the contacting line of orifice 12. The outer portion of orifice 12 is shown in dashed line for reference purposes.

The object of providing a hollow plug 20 is to permit the passage of compressed air through plug 20 and openings 23 to the area of contact between the covering materials and the orifice 12. As shown, the plug 20 is covered by a conical pad of refractory material 16 and a layer of insulating glass material 17. The layer 16 might be asbestos and the layer 17 a suitable dense insulating glass fiber mat or a mat of glass wool. The cooling air directed through the openings 23 prevents the glass at the line of contact from deteriorating under the heat to which it is subjected and the pressure exerted through the pad 16. This greatly extends the life of the insulating mat. Although some metal might freeze about the periphery of the orifice 12, the remaining portions of the conical pad 16 are still fully insulated as before, and the metal will not freeze across the entire orifice 12. The use of cooling air extends the life of the glass material and prevents its deterioration. It greatly extends the usefulness of an assembly of covering materials and permits it to be reused many more times than is possible when air is not utilized. A conventional air compressor (not shown) can be used to supply air through the rod 22 for cooling purposes.

Other modifications may be made in this assembly without deviating from the basic concept of providing effective resilient insulation behind the refractory pad. Therefore, the extent of this disclosure and the invention set out herein is not to be limited except as set out in the following claims.

We claim:

1. In an apparatus for sealing the flow of molten metal from a receptacle comprising:

a tapping block having a cylindrical orifice formed

therethrough;

a conical plug having a maximum diameter greater than the diameter of the block orifice;

mounting means releasably connected between said receptacle and plug to hold the plug partially within the block orifice wherein a line of contact may be made between the outer peripheral surface of the plug and the inner periphery of the orifice; and

a resilient refractory fiber pad covering said plug about the conical surface thereof;

the improvement comprising:

a glass fiber mat outward of the conical plug and interposed between the pad and plug, the thickness of the mat being substantially in excess of the thickness of the pad, the mat completely overlying and covering the conical surface of the plug, including the area of contact between said plug and the orifice; and

said mat being secured to the pad as a unitary structure, the pad and mat each being formed as coaxial conical members in surface to surface contact with one another.

2. The apparatus as set out in claim 1 further comprising a second resilient refractory fiber pad interposed between the plug and said mat.

3. In an apparatus for sealing the flow of molten metal from a receptacle comprising:

a tapping block having a cylindrical orifice formed therethrough;

a conical plug having a maximum diameter greater than the diameter of the block orifice;

mounting means releasably connected between said receptacle and plug to hold the plug partially within the block orifice wherein a line of contact may be made between the outer peripheral surface of the plug and the inner periphery of the orifice; and

a resilient refractory fiber pad covering said plug about the conical surface thereof;

the improvement comprising:

a glass fiber mat interposed between said pad and said plug in the area of contact between said plug and the orifice;

a source of compressed air; and

means within said plug operatively connected to said source of compressed air for directing the air to said mat about the area of contact between the plug and the orifice.