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[54] FILTRATION OF MOLTEN METAL

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[51] **Int. Cl.**.....**B01d 35/28**

[58] **Field of Search**.....210/69, 71, 72, 83, 210/242

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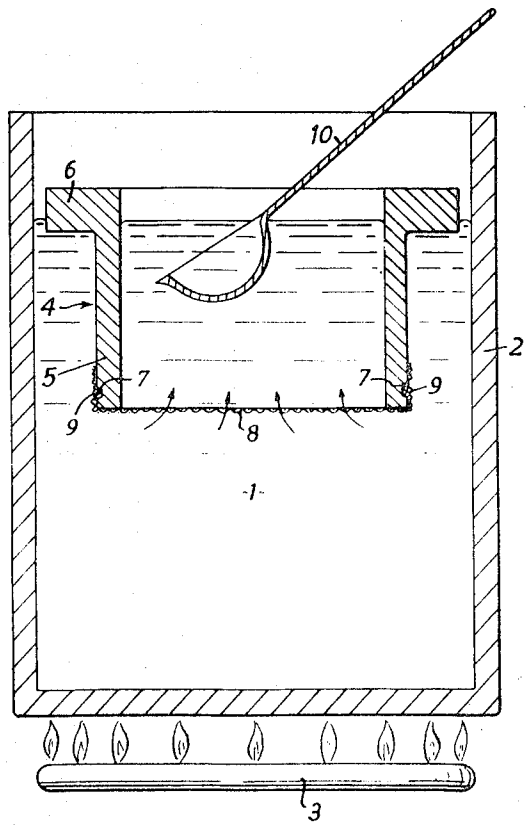
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[57] **ABSTRACT**

In the production of light metal castings by manual methods molten metal is drawn in a ladle from a pool of metal within a filter floating freely in a body of molten metal in a holding furnace. The filter comprises a body made of a material which is not attacked by the molten metal and is provided with one or more apertures at or near the bottom end, these apertures being covered with filter material so that solid inclusions are removed from molten metal entering the filter body.

4 Claims, 2 Drawing Figures



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2 Sheets-Sheet 1

FIG. 1

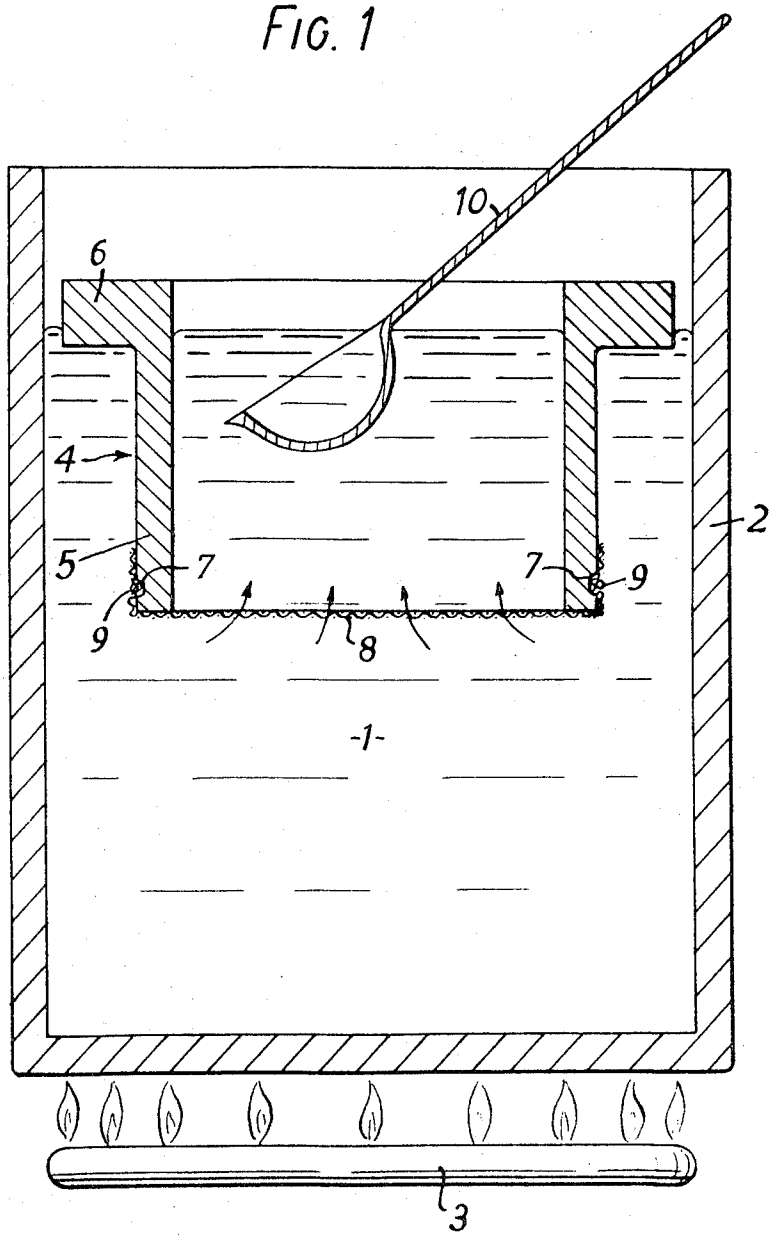
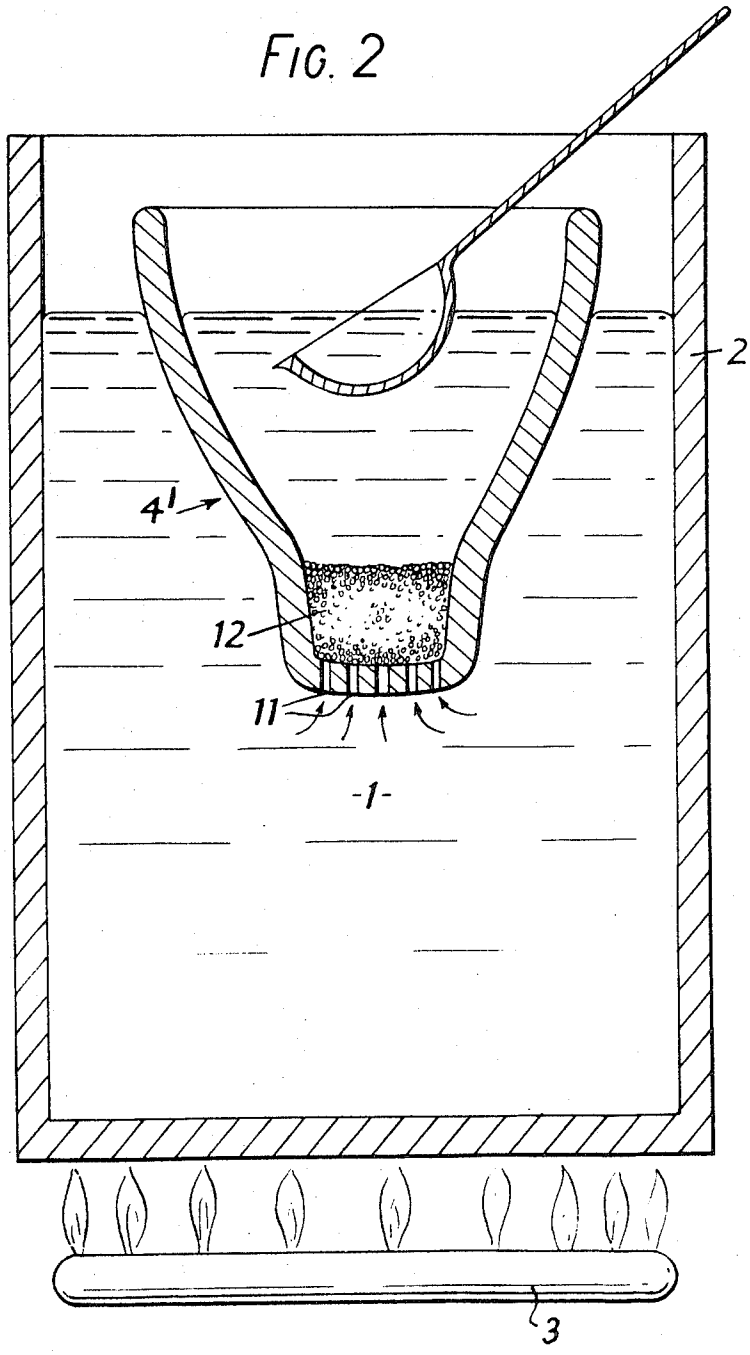


FIG. 2



FILTRATION OF MOLTEN METAL

The present invention relates to casting of light metals, particularly aluminum (including aluminum alloys) but also of other metals having comparably low melting points, such as magnesium and its alloys. In particular the present invention relates to a method of filtering molten metal in the production of castings.

The production of light metal castings, other than pressure die castings, is essentially a manual operation, in which molten metal is withdrawn from a holding furnace by means of a ladle. Large quantities of internal combustion engine pistons are produced by pouring molten aluminum alloy by means of a hand-held ladle into permanent steel moulds. In producing this class of gravity die-castings molten metal is taken from the holding furnace in a quantity measured only by the operator's eye and any surplus in the ladle is returned to the holding furnace before refilling the ladle for the next casting operation.

Piston castings, for example, are machined. Any inclusions of hard aluminum oxide are very objectionable both for the wear imposed on the cutting tools during machining and for the likely wear on the cylinder surfaces from any hard oxide exposed on the cylindrical outer surface of the piston. In the production of aluminum alloy piston castings by normal production methods, a significant proportion of the castings are rejected for this reason.

It is well known in the production of aluminum and aluminum alloy ingots to filter the molten metal during the pouring of the metal into the continuous casting mould. A glass cloth bag has been found to be a particularly suitable medium for the removal of solids, such as aluminum oxide, in this context.

In the production of aluminum alloy castings the metal is melted in a large capacity melting furnace from which it is transferred to a number of small holding furnaces, from which one or occasionally more operators may draw molten metal by means of a ladle. The aluminum oxide dross is mainly produced in the melting furnace and during pouring from the melting furnace into the holding furnace, but does not arise to any significant extent in the holding furnace. Such oxide dross as is produced in the holding furnace is in the form of a very fine film. Filtration of the metal in the holding furnace should therefore very largely obviate the introduction of oxide, particularly in the form of large hard grains, into the castings.

It has already been proposed to incorporate filter fixtures of various kinds into the holding furnace. Some forms of filter fixtures have required periodic vertical adjustment to take account of variation in the metal level in the furnace or have retarded removal of metal from the furnace when the metal level is low. Such filter fixtures have thus reduced the rate of production attainable by the operator and have thus not been generally adopted in the production of aluminum alloy castings. It has already been proposed to filter aluminum in a holding furnace by means of a crucible which is supported by a framework extending across the mouth of the furnace. Metal enters the crucible through apertures in the bottom and rises through a bed of granular filter material. As already stated the disadvantage of that type of filtering device is that the level of metal in the crucible is dependent upon the level of molten metal in the holding furnace with the result that a decrease in metal level also results in a drop in the metal level in the crucible with resultant difficulty in withdrawal of molten metal in a ladle.

In another similar arrangement the crucible was held on a variable support for height adjustment. Since in such arrangement the support extends downwardly into the furnace from above it causes obstruction in the accessibility of the pool of metal in the filter to the ladle.

It has now been appreciated in accordance with the present invention that these objections can be overcome if the filter body is arranged as a free floating unit in the holding furnace. The most suitable material for the construction of a floating filter body for filtering molten aluminum is plumbago (graphite) which is substantially unaffected by molten aluminum and has an appropriate density, that is to say somewhat less than the density of molten aluminum. However any other material which can resist molten aluminum and has a density in the range of 1.5 – 2.5 would be suitable for the purpose of filtering molten aluminum and indeed some material of lower density may be employed in some circumstances.

In constructing a floating filter a number of considerations must be observed. Thus the width and depth of the pool of molten metal within the filter must be sufficient to permit substantially unimpeded removal of metal in the ladle. Furthermore the height of the filter body above the metal level must be kept small so as to avoid obstruction of the handling of the ladle by the operator. Additionally the filter must be arranged so that it is fairly stable and not easily overturned by accidental contact with the ladle, which would result in the admission of unfiltered metal into the pool of metal within the filter body. In general it is preferred that the mouth diameter of the mouth of the filter body be in excess of its depth.

The invention is further described with reference to the accompanying drawings, wherein :

FIG. 1 illustrates one form of filter for carrying out the method of the present invention.

FIG. 2 illustrates a second form of filter for carrying out the method of the invention.

In both FIGS. 1 and 2 a body 1 of molten aluminum alloy is maintained in a holding furnace 2, which is heated by gas burners 3. For convenience of illustration the holding furnace 2 is shown greatly reduced in size and in practical operation it would be substantially larger in diameter than the filters 4 and 4'.

The filter 4 shown in FIG. 1 comprises a cylindrical body 5 having an outwardly extending peripheral flange 6. A shallow groove 7 is formed in the wall of the cylindrical body 5 near the bottom end of the filter body 4. This permits a layer of glass cloth 8 to be secured across the open bottom end of the body 5 by means of a glass binder thread 9.

The body 5 is formed of dense graphite of a density around 2.5 but may be formed of other material which is substantially unaffected by molten aluminum, provided that such material is less dense than molten aluminum. The weight of the filter body can be increased by means of an iron ring embedded in the graphite so as to be protected from contact by molten aluminum to sink the filter 4 further into the aluminum, but this is not usually necessary.

In operation metal is removed from the pool of molten metal within the filter **4** by means of a ladle **10**. This reduces the level of the metal in the filter and the body **5** rises in the body **1** of metal. Metal then rises through the glass cloth **8** to restore the level of the metal in the filter body with that of the body **1**. Any grains of oxide or other solid in the metal are removed by the filtering action of the glass cloth **8**. As the filter body rises in the metal as the result of the removal of a ladle full of molten metal, there is some tendency for the solid grains to be shaken off the glass cloth and thus the filter has some self-cleaning tendency.

An alternative form of floating filter **4'** is shown in FIG. **2**. In this case the floating filter **4'** takes the form of a graphite crucible with a series of apertures **11** formed in the bottom of it. A bed **12** of granular filter material is supported in the bottom of the filter and performs the same function as the glass cloth **8**. The bed **12** is preferably trapped beneath in a perforated disc (not shown).

The floating filter of FIG. **1** is the preferred arrangement, both because metal removed in the ladle is more quickly replaced through the glass cloth and because the filter body is more inherently stable and is very difficult to upset by contact with the ladle. The layer of glass cloth is very easy to replace.

We claim :

1. A method of filtering metal in the production of castings comprising placing a freely floating filter member in a body of molten metal, said filter member having an open top and an imperforate side wall formed of a material, which is substantially unaffected by the molten metal, while permitting molten metal to enter the filter member at the bottom end thereof through a filter medium associated with said bottom end, so that said molten metal rises from below the level of said body and only through said filter medium to form a pool in said member, said filter member allowing sufficient width and depth of said pool formed by said rise of filtered molten metal within said member, to permit substantially unimpeded removal of metal in a ladle, and withdrawing molten metal through the top of said filter member by inserting a ladle into submergence in said pool and removing the filled ladle through said top of the member, and thus causing further molten metal to rise into said filter member through said filter medium from the body of molten metal.

2. A method according to claim **1** in which molten aluminum is filtered by means of a filter member formed of graphite.

3. A method according to claim **2** in which the pool of molten metal is formed in essentially cylindrical shape by containment in said side wall of essentially cylindrical form, said molten metal being filtered by rising through glass cloth constituting said filter medium closing said bottom end of the filter member.

4. A method according to claim **3** which includes stabilizing the floating of said member by providing outward support in the molten metal, around the mouth of the member, with a peripheral flange.

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