United States Patent [19]

Vallak

[11] **3,929,183**

[45] **Dec. 30, 1975**

[54] **METHOD FOR SEALED SYSTEM OF HOT TOPS, INGOT MOULDS OR A COMBINATION OF INGOT MOULD AND HOT TOP AND AN ARRANGEMENT FOR SAID SEALED SYSTEM**

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[22] Filed: **June 25, 1974**

[21] Appl. No.: **482,882**

[30] **Foreign Application Priority Data**

July 6, 1973 Sweden 7309558

[52] **U.S. Cl.** **164/123;** 249/106; 249/200

[51] **Int. Cl.²** **B22D 7/10;** B22D 27/06

[58] **Field of Search** 164/123; 249/200, 79, 106

[56] **References Cited**

UNITED STATES PATENTS

1,425,658	8/1922	Jamison	249/200
1,719,542	7/1929	Gathmann	164/123 X
2,102,258	12/1937	Dornin	164/123 X
3,072,985	1/1963	Ahmansson et al.	164/123 X
3,766,965	10/1973	Vallak	164/123

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Assistant Examiner—John E. Roethel
Attorney, Agent, or Firm—Finnegan, Henderson, Farabow & Garrett

[57] **ABSTRACT**

The invention relates to a method of casting metals or metal alloys in an ingot mould provided with a desired type of hot top, whereby the pipe reducing effect of the hot top is further enhanced by means of applying a layer of granulated or powdered heat radiation retarding material above the ingot mould after completion of the teeming of the metal. The pipe reducing means is included in a sealed system for hot tops, moulds and the like. The heat radiation retarding means is sealed in a heat combustible or burstable casing in said pipe reducing means and is removed at a suitable time by means of suction prior to the removal of the ingot from the mould and is collected in a suitable container for reuse.

15 Claims, 5 Drawing Figures

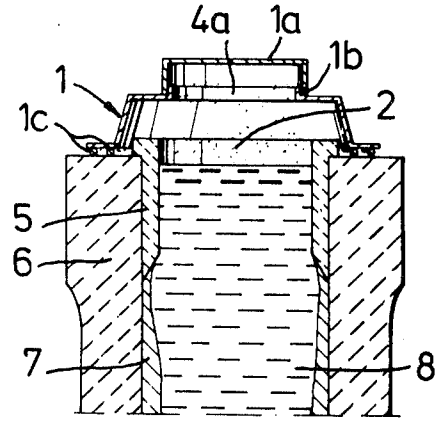


FIG. 1

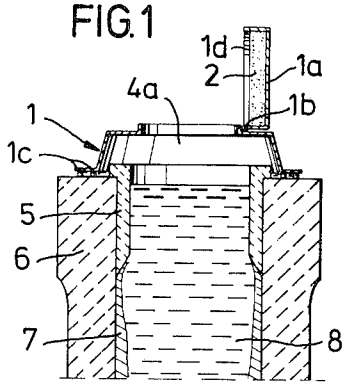


FIG. 2

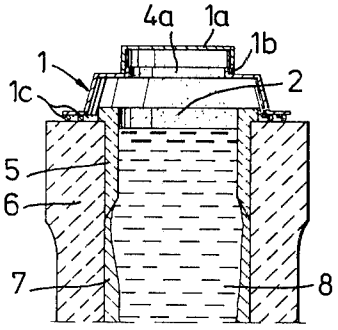


FIG. 3

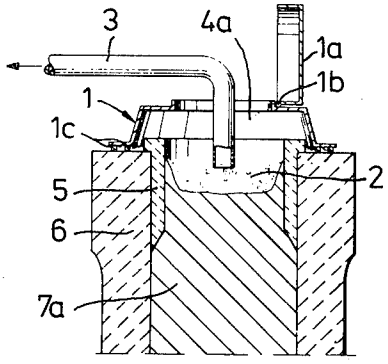


FIG. 4

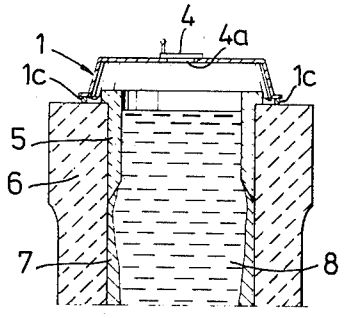
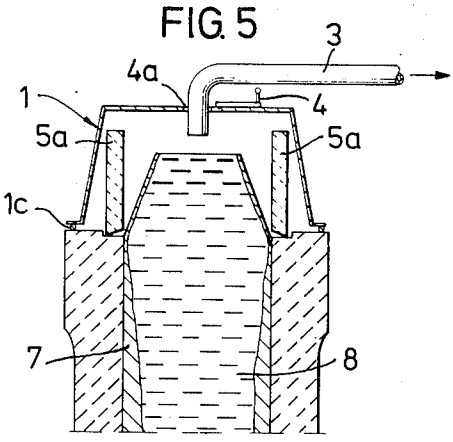


FIG. 5



METHOD FOR SEALED SYSTEM OF HOT TOPS, INGOT MOULDS OR A COMBINATION OF INGOT MOULD AND HOT TOP AND AN ARRANGEMENT FOR SAID SEALED SYSTEM

The present invention relates to a method for the casting of ingots of metal or metal alloys, for example steel, in an ingot mould equipped with a hot top of desired type, for example a Vallak hot top U.S. Pat. No. 3,766,965, for the reduction of piping in the top of the ingot, said hot top being placed inside or on top of the top of the ingot mould.

The anti-piping effect of the hot top can be further enhanced through the introduction of a layer which retards heat radiation, open to the surrounding atmosphere and working environment. This layer consists of a material which is held in place by its own weight, i.e., is of high specific gravity and thus of high heat-absorbing ability, said layer, at the same time, being non-injurious to the health and non-toxic for the surroundings, said heat-retarding layer being either a powder or a formed body with sufficiently high density to remain in place on the cast ingot.

One disadvantage with hitherto known methods is that the material used for heat retarding has also been heat absorbing. A second disadvantage is that it has not been possible to use health-hazardous or non-heat-absorbing materials because their utilization in the casting process, which entails polluting the working environment, has been prohibited in most countries by existing labor legislation. Such non-heat-absorbing materials are, for the most part, either health-hazardous or they exist in such finely powdered form that they have an injurious effect on the breathing organs of the operator, etc., and are therefore prohibited.

According to the present invention, a method is achieved for a sealed system for hot tops, ingot moulds or a combination of hot tops and ingot moulds, as well as a device for the sealed system, said method and device eliminating the above-mentioned disadvantages.

In the present invention, the new method is characterized in that after teeming of the metal is completed, an anti-piping means is applied on the ingot mould, said means being contained in a closed system for hot tops, ingot moulds or a combination of hot tops and ingot moulds.

The method according to the invention is characterized further in that the anti-piping means is provided with a heat retarding material which is essentially non-heat-absorbing.

The method is further characterized in that the heat retarding but essentially non-heat-absorbing material with which the anti-piping means is fitted may be of health-hazardous or non-health-hazardous material.

The method according to the invention is characterized further in that the heat retarding but essentially non-heat-absorbing material is afforded in powdered or granular form.

The method according to the invention is characterized further in that the powdered or granular heat retarding but essentially non-heat-absorbing material is affixed in the anti-piping means enclosed in or covered by a casing of, for example, plastic which is degradable under the ingot heat.

The method according to the invention is characterized further in that the affixed material in the anti-piping means is drawn out of said means at an appropriate,

i.e. safe from a health-hazardous standpoint, time prior to withdrawal of the ingot from the ingot mould.

The method according to the invention is characterized further in that the affixed material is drawn out and transferred to a collecting vessel for re-use.

The method according to the invention is characterized further in that the heat retarding but essentially non heat-absorbing material charges the anti-piping means with one or more of the following materials in powdered or granular form: Ytong, Siporex, quicklime, calcined dolomite, crushed brick (for example chamotte), anti-piping compounds, materials with high silica or silicate content, materials which are known to be good insulators but are health-hazardous when airborne, as asbestos and mica.

According to the present invention there is also an apparatus for conducting the method.

The apparatus according to the invention is characterized in that it comprises a sealed system of means contained in the apparatus.

The apparatus is characterized further in that the sealed system comprises a cover fitted with a heat retarding but essentially non-heat-absorbing material, a seal to the ingot mould, a suction or evacuating orifice, a connection pipe, an evacuation means which in itself is known and which operates by means of sub-pressure with an accompanying collecting vessel.

Further characteristics of the apparatus, i.e. the apparatus system, according to the invention will be made clear in the following description with reference to the accompanying drawing and by the subsequent claims.

Identical or similar details in the different Figures are indicated with the same reference numerals in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional view of a closed system ingot mould formed in accordance with one embodiment of this invention, the mould being in position for receipt of molten metal.

FIG. **2** is a cross-sectional view of the embodiment of FIG. **1** after the molten metal has been introduced into the mould, and the closed system has been sealed and heat radiation retarding material has been deposited on the molten metal in the hot top.

FIG. **3** is a cross-sectional view of the embodiment of FIG. **1** after the ingot has solidified showing a means for removing the heat radiation retarding material.

FIG. **4** is a cross-sectional view of another embodiment.

FIG. **5** is a cross-sectional view of a third embodiment for use with four-piece cast iron hot tops.

FIG. **1** shows a cover for hot tops in the sealed system, i.e. the apparatus, generally indicated with **1** and an arrow. Cover **1** has a hinged, box-shaped, downward open lid **1***a* affixable to cover **1** by means of a hinge or the like **1***b*. The lid **1***a* is filled with a heat retarding, fine grained material, for example enclosed in a burnable bag or loosely enclosed in the lid **1***a*, the lid and material **2** being covered with a covering of for example plastic. The lid **1***a* is shown in the open position. **1***c* is a seal or seals between the cover **1** and the upper portion of an ingot mould **6**. A hot top **5** is shown inside the ingot mould, said hot top being for example of the Vallak type. **7** represents metal which has begun to solidify and **8** represents metal which is still molten. An opening **4***a* at the top of the cover indicates an opening which is somewhat smaller than the opening in the lid **1***a*.

FIG. 2 differs from FIG. 1 in that the lid 1*a* is now shown in the closed position, whereby for example the covering 1*d* has been burned up or burst due to the heat emitted from the molten metal, resulting in that the heat retarding material 2 is released and floats on or is fluidized above the surface of the molten metal inside the hot top. In FIG. 2, the system in the hot top is sealed.

FIG. 3 shows the lid 1*a*, now without its contents, in the open position. The heat retarding material 2 (can also be called insulating material) rests above the solidified metal 7*a*. A suction pipe 3 is shown inserted through the opening 4*a* in the cover 1. The suction pipe can be connected to an arrangement for sucking up dusty residues in hot tops, such as the arrangement described Pat. copending U.S. patent appln. Ser. No. 450,430 assigned to Enn Vallak. The arrow pointing to the left shall disclose that sub-pressure prevails in the suction pipe so that said pipe can suck up and carry away the material 2.

FIG. 4 shows another design of the cover 1 in the sealed system for hot tops according to the present invention. The upper portion of the cover 1 is still provided with an opening 4*a* which now does not have to be larger than to allow entrance for the suction pipe 3 shown in FIGS. 3 and 5. This opening 4*a* is covered by means of a turnable lid which, when turned to the side, exposes opening 4*a*. The turnable lid 4 can also be replaced with a sliding plate or some other means which cover opening 4*a*.

FIG. 5 shows the suction pipe 3 when inserted through opening 4*a*. In FIGS. 4 and 5, insulating material 2 is not specifically shown but it is considered to be present as shown in FIGS. 2 or 3.

FIG. 5 shows the cover 1 in the sealed system for hot tops according to the present invention when the casting of the metal is carried out with the use of a four-piece cast iron cover according to U.S. Pat. No. 3,766,965. The four-piece cast iron cover in FIG. 5, marked 5*a*, is shown in a removed position. FIG. 5 shows that, in this case, the cover 1 has an essentially higher design.

The cover 1 shown in FIGS. 1–5 can be preformed as a permanent or reusable cover and therewith be preformed of a plate material of sufficient thickness so as not to be deformed when it is subjected to heat radiation. As an alternative, the cover 1 can be preformed so as to be used only once and, therewith, a paper material, preferably impregnated, can be used. The cover can therewith have been preformed by means of pressing a suitable paper material in a press mould, whereby an inexpensive disposable type of cover made of paper can be manufactured for said purpose.

The seal 1*c* shown in FIGS. 1–5 is included as a seal (which in itself is known) in the sealed system for hot tops according to the present invention. The seal can be designed as a strip of sand and is composed of asbestos or tarred cord (for example of the Copeseal type) or, quite simply, mortar can be used as a seal. Labyrinth seals can be used as well. The choice of the type of seal is dependent on the size of the ingot mould, type of hot top, height of the cover, etc.

When carrying out the method according to the invention by means of the use of the sealed system according to the invention, the following procedure is used.

The insulating material 2 is packed, for example in a bag which is placed in the lid 1*a*, and held in the same by means of tape or some other burnable or burstable adhesive material. As an alternative, the fine-grained material is packed in loose form into the lid 1*a* and covered with a covering 1*d* which can be comprised of a material which can be formed around the lid 1*a*, for example plastic sheeting. The cover 1 with its lid 1*a* is then applied to the mould 6 above the seal 1*c* whereby - by means of the lid 1*a* being opened - the pouring or teeming of the metal 8 can take place in the mould through the opening 4*a* in the cover 1. When the metal has risen sufficiently in the hot top 5, the lid 1*a* is closed and the covering 1*d* or the bag in which the material 2 is contained burns up or bursts and the contents 2 of the lid fall out and lie on top of the molten metal in the hot top and remain there resting or floating above the molten metal for such a period of time until which the initial solidification of the molten metal (represented by 7) has proceeded so long that the solidifying process in the hot top as well can from experience be considered to have achieved its end point. Due to the scaled system which the cover 1 builds with the mould 6 and hot top 5, respectively, no harmful smoke, vapour or substance can leak out into the working area. When the entire solidification process can be considered to have been completed, the lid 1*a* is opened and the suction pipe 3 is inserted through the opening 4*a* and, by means of sub-pressure in said suction pipe 3, the material 2 is sucked out into a suitable collecting container, for example according to the method and device disclosed in the above-mentioned U.S. Pat. appln. Ser. No. 450,430.

When the cover 1 has the design shown in FIGS. 4 and 5, the cover 1, along with the seal 1*c*, is set on the mould after the pouring or teeming of the metal has been completed. In this case, the insulating material 2 is applied enclosed in a bag or the like, in the upper portion of the cover 1 before said cover is applied on the mould 6. By means of combustion or bursting of the casing or bag surrounding the insulating material 2, said material is released and collected above the molten metal as described in the case when the cover was already applied to the mould. Even in this case, with the cover being applied on the mould, a sealed system in accordance with the invention is obtained. When the hardening process has proceeded sufficiently, the lid or plate 4 on the cover is removed in order to expose an opening 4*a* which is sufficiently large so as to allow the insertion of the suction pipe 3. After this has been done, one proceeds in the same manner as in the above case.

The invention makes possible the use of inexpensive, effective covering means which presently cannot be used or which are avoided because of the health risk that for example asbestos and silica-containing materials entail. The invention also makes it possible for conventional, heat insulating hot tops to be made of material containing inexpensive, hazardous material, as the cover which surrounds the pipe-preventive means can also surround the hot tops, preventing dust from the hot tops during the use of the same from floating freely in the air. This entails large economic savings due to the fact that expensive, non-hazardous material can be replaced with inexpensive material which would be hazardous if it were spread freely in the air. These economic savings are magnified as the material which

can be used may be used over again in the manner described earlier in this text.

I claim:

1. An improved method of casting metals in an ingot mould comprising the steps of enclosing a heat radiation retarding material in a sealed enclosure, teeming molten metal into said mould through an open end of said mould, positioning said sealed enclosure and material within said mould, closing said open end of said mould, releasing said material from said enclosure onto the molten metal while said mould is closed thereby ensuring that the heat radiation retarding material is not dispensed in the air surrounding the exterior of the mould.

2. The method of claim 1 wherein said material is enclosed by sealing said material within a bag and including the steps of attaching said bag to the interior surface of a closure means and placing the closure means over said open end of said mould to seal said bag within said mould.

3. The method of claim 1 wherein said material is released from said enclosure by exposing said enclosure to the heat from said molten metal causing said enclosure to open.

4. The method of claim 1 including the step of removing said material from the ingot mould while said mould is closed.

5. In an improved method of casting metals in an ingot mould, of the type wherein metal in a molten state is placed in the ingot mould, and a heat retaining means including heat radiation retarding material is placed over the exposed molten metal at the open end of the ingot mould, the improvement comprising:

a. enclosing the heat radiation retarding material in sealed means;
b. positioning said sealed means and material at said open end of the ingot mould;
c. closing the open end of the ingot mould with said sealing means and material within said mould;
d. releasing the heat radiation retarding material onto the molten metal while said ingot mould is closed thereby ensuring that the heat radiation retarding material is not dispersed in the air surrounding the exterior of the ingot mould.

6. An improved method of claim 5 wherein said heat radiation retarding material is a non-heat absorbing insulating material which is hazardous to the health when dispersed in the air and is selected from the group consisting of quick lime, calcined dolomite, crushed brick, anti-piping compounds, material having high silica content, material having high silicate content, asbestos-containing materials and mica.

7. A sealed ingot mould system for casting metals comprising a mould having an open upper end through which molten metal may be teemed into said mould, a cover for closing the open end of said mould, heat radiation retarding material encased on the interior surface of said cover facing the interior of said mould when said cover is in position to close said mould, means responsive to the heat of said molten metal for releasing said material onto the molten metal while said cover is in the closed position.

8. An ingot mould system as defined in claim 7 wherein said material is enclosed within a bag which releases said material therefrom when said bag is exposed to said molten metal.

9. A sealed ingot mould system as defined in claim 7 wherein said means for releasing said material burns upon being exposed to said molten metal.

10. An ingot mould system as defined in claim 8 wherein said heat radiation retarding material is a non-heat absorbing material.

11. An ingot mould system as defined in claim 8 wherein said non-heat absorbing material is in powder form.

12. An ingot mould system as defined in claim 8 wherein said non-heat absorbing material is in granular form.

13. An ingot mould system as defined in claim 8 wherein said heat radiation retarding material is a non-heat absorbing insulating material which is hazardous to the health when dispersed in the air and is selected from the group consisting of quick lime, calcined dolomite, crushed brick, anti-piping compounds, material having high silica content, material having high silica content, asbestos-containing materials, and mica.

14. In an improved ingot mould for the casting of metals, of the type wherein metal in a molten state is placed in said ingot mould and a heat retaining means including heat radiation retarding material is placed over the molten metal at the open end of said ingot mould, the improvement comprising:

a. a cover for closing the open end of said ingot mould;
b. retaining means for holding said heat radiation retarding material within said cover;
c. means for sealing said cover to the top of said ingot mould in order to prevent dispersion of said heat retaining means outside of said ingot mould;
d. means for releasing said heat radiation retarding material onto the molten metal after the open end of said ingot mould is closed by said cover.

15. An improved ingot mould as defined in claim 14 including an access opening through said cover and means for removing said heat radiation retarding material from said mould through said access means while said cover is closed to ensure that said material is not dispersed in the air surrounding the exterior of the ingot mould.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,929,183 Dated December 30, 1975

Inventor(s) Hannes Vallak

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 6, line 31, "silica" second occurrence should read --- silicate ---.

Signed and Sealed this

eighteenth Day of May 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks