Aug. 1, 1933. E. GATHMANN 1,920,854

HEAT INSULATING MEANS FOR USE IN PRODUCING METALLIC CASTINGS

Original Filed July 6, 1932

Fig. 1.

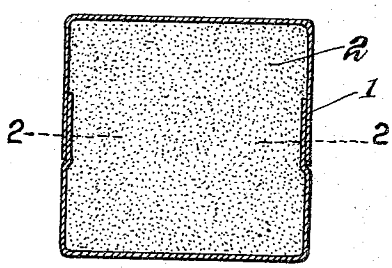


Fig. 2.

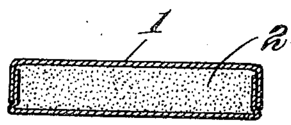


Fig. 3.

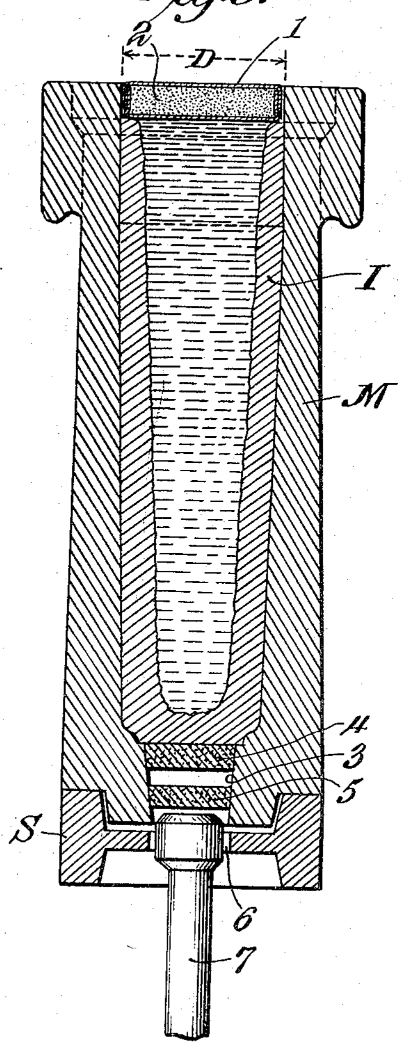
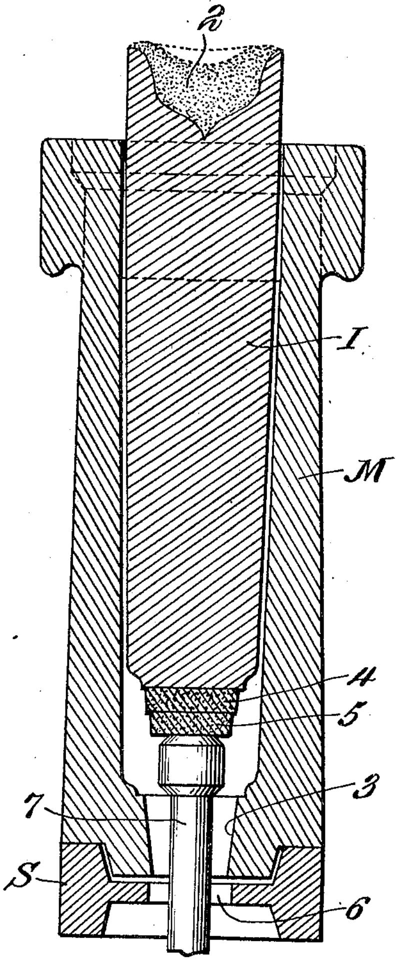


Fig. 4.



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1,920,854

HEAT INSULATING MEANS FOR USE IN PRODUCING METALLIC CASTINGS

Emil Gathmann, Baltimore, Md.

Original application July 6, 1932, Serial No. 621,100. Divided and this application September 26, 1932. Serial No. 634,950

5 Claims. (Cl. 22—1)

This invention relates to heat insulating means for use in producing metallic castings and more particularly to means used for insulating the exposed top surface of a mass of molten metal after it is poured into an ingot mold. Means in accordance with the present invention may be used to advantage in various cases where it is desired to insulate the exposed top surface of a quantity of molten metal but is especially useful for insulating the top surface of a mass of ingot metal after it has been poured into a mold, and the embodiment of the invention described herein and shown by way of example in the accompanying drawing, while illustrating the general principles underlying the invention, is designed especially for use in combination with metallic ingot molds.

As is now well known, in order to produce sound ingots commercially, it is necessary that the ingot metal be cast in molds of the big-end-up type, so that solidification of the metal will be progressive from the bottom toward the top of the mold, and the metal at the top will be maintained in a liquid state until the lower and intermediate portions of the metal have solidified. The molten metal feeding downwardly prevents the formation of a shrinkage cavity or pipe in the body of the ingot. In order to minimize the depth of the shrinkage cavity at the top of the ingot, shrink head casings of refractory material have been used for insulating the metal at the top of the ingot. By practicing the method of producing ingots disclosed and claimed in my copending application 621,100, filed July 6, 1932, of which the present application is a division, the use of shrink head casings may be dispensed with.

In accordance with the method disclosed in the application referred to, molten metal is poured into a mold of the big-end-up type provided with a bottom opening closed during pouring by a removable closure plug or the like. After the metal has solidified throughout a predetermined part of its volume, preferably between sixty and ninety per cent, a stripping device is raised upwardly through the mold bottom opening in order to raise or strip the ingot partially from the mold, so that the upper portion of the ingot will be moved up beyond the top of the mold. When the ingot is in this position, relatively cool air is caused to flow upwardly through the mold bottom opening and into the bottom of the mold chamber. The air, becoming highly heated and rarified by contact with the hot mold walls and hot ingot, automatically flows upwardly through the annular gap between the ingot and the mold due to the draft created by the heating of the air. The entering air, contacting the bottom portions of the ingot, will be relatively cooler as compared to the air which has been in contact with the bottom of the ingot and which has passed along the ingot, the result being that air contacting the ingot has a cooling effect which is progressively less from the bottom to the top of the ingot. This results in more rapid heat abstraction and consequent quicker solidification of the lower and intermediate portions of the ingot than of its upper portion, so that the formation of a deep seated shrinkage cavity or pipe within the body of the ingot is prevented. As previously stated, by practicing the method outlined above it is unnecessary to use shrink head casings as has heretofore been the practice, particularly in connection with molds of the big-end-up type.

In addition to insulating the top portion of an ingot by means of a shrink head casing, which, it will be understood, serves to insulate only the sides of the top portion, it has been quite common practice to place upon the exposed upper surface of the ingot metal a covering of insulating material, this material being placed upon the molten ingot metal as soon as pouring has been completed. The broad idea of placing insulating material upon the top surface of molten ingot metal subsequent to its being poured into an ingot mold is illustrated, for example, in my prior Patents 1,049,573, of January 7, 1913; 1,711,052, of April 30, 1929; and 1,739,222, of December 10, 1929.

In order to obtain the full advantages of the use of insulating material on the top surface of the molten ingot metal, it is desirable that the insulating material be as moisture-free as practical and that a sufficient amount be used at least to fill the shrinkage cavity completely as it forms due to the contraction incident to solidification. In prior practice, whenever material has been placed on the top of the ingot to conserve the heat of the latter, it has been usual for an unskilled laborer simply to throw an indeterminate and usually insufficient quantity of the material from a shovel or the like. The material, being taken from a pile on the pouring floor or from an open container, contains a considerable amount of moisture, which varies with the humidity of the air and which tends to chill the top of the forming ingot. Experience has demonstrated that for best results the heat insulating material not only should be as dry as possible, but also should be used in a relatively definite amount, depending upon the size of the mold. In accordance with prior practice, rather indiscriminate amounts of insulating material have been used, sometimes not enough to provide the necessary heat insulation and sometimes an excessive and therefore wasteful amount.

An object of the invention is to provide improved means for insulating the top horizontal surface of a mass of molten metal after pouring into an open top mold with a desired predetermined or measured quantity of properly conditioned insulating material. More specific objects will become apparent from a reading of the following description, the appended claims, and the accompanying drawing, in which:

Figure 1 is a horizontal sectional view of means for insulating the top surface of an ingot constructed in accordance with the invention;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a transverse vertical sectional view of an ingot mold and contained ingot metal showing my improved insulating means in position at the top of the mold, the ingot metal being shown as in the initial stage of solidification; and

Figure 4 is a view similar to Figure 1 but showing the ingot as being completely solidified and as being in partially stripped position

Referring to Figures 1 and 2, there is shown by way of illustration a practical embodiment of the insulating means of the present invention comprising a jacket 1 filled with a quantity of loose finely divided heat insulating material, the jacket preferably completely enveloping the material 2 so as to protect it against contact with the atmosphere and to prevent its absorbing moisture.

Figures 3 and 4 illustrate the insulating means as used in connection with an ingot mold M of the big-end-up type which may be a mold of the Gathmann type now well known to the art and shown for example in my Patent No. 1,806,753, of May 26, 1931. The mold M is supported on a stool S which in turn may be carried by a transfer car or by any other suitable support. The mold is provided with a necked-in tapered bottom opening 3 which is closed by means of spaced closure plugs 4 and 5. The stool S is provided with an opening 6 in alignment with the mold bottom opening. A stripper rod 7 is shown as being mounted for sliding movements upwardly through the openings 6 and 3 in the stool and mold respectively and into engagement with the closure plugs for moving the ingot I relatively upwardly through the mold. The stripper rod may be formed or provided with means for cooperation with a latch or the like when the stripper rod has been raised and the ingot partially lifted or stripped from the mold to the desired extent for maintaining the ingot elevated to permit cool air to pass upwardly through the annular space between the mold and ingot to facilitate cooling of the latter in accordance with the method referred to above and disclosed more specifically in my copending application Serial No. 621,100 also referred to above.

It will be understood that, when the ignot metal has been poured into the mold M so as substantially to fill the latter but preferably so that the surface of the ingot metal is just a little below the extreme top surface of the mold, the jacket 1 containing the insulating material 2, being portable, is placed upon the top surface of the ingot metal as indicated in Figure 3. The jacket will be destroyed by the heat of the ingot metal, and the insulating material 2 will be deposited evenly over the top surface of the ingot metal so as to insulate the latter effectively. When solidification of the ingot is complete, the insulating material 2 will still cover the top of the ingot, as shown in Figure 4. Although the insulating means of the present invention has been illustrated in connection with a mold not provided with a shrink head casing, it will be understood that it may be used also in connection with molds equipped with shrink head casings.

I have found that for best results when casting steel ingots in molds having vertically extending chambers the insulating material 2 should have a depth of from about one quarter to three quarters of the minimum cross section D of the ingot at its top, as shown in Figures 3 and 4 of the drawing. For instance, where the ingot has a cross sectional dimension of 20x22″, the depth or thickness of the blanket of heat insulating material should be at least 5″ and usually need not exceed 15″, the specific depth being dependent upon the temperature and analysis of the steel being poured. In order that the material applied to the top of the ingot be as moisture free as possible and in order to insure the use of a sufficient amount, I prefer to employ as the jacket 1 a substantially moisture proof carton—a paper bag or the like capable of being destroyed by the heat of the ingot metal at pouring temperature—filled with a measured quantity, two to six percent of the volume of the ingot metal, of dry, loose, finely divided material, preferably diatomite or infusorial earth, which is readily obtainable, inexpensive, and when dry one of the best non-conductors of heat known for the purpose. For certain types of steel, this material may comprise an admixture of comminuted straw or other combustible heat-producing material and diatomite or other non-combustible heat-insulating material.

When the ingot metal has been poured, the jacket containing the measured quantity of insulating material is deposited at once bodily on the top surface of the fluid ingot metal, whereupon the jacket 1 will be burned and the material 2 will be deposited substantially evenly over the surface of the molten metal. The upper surface of the ingot will then remain molten and will feed the contracting ingot to compensate for the shrinkage of the lower portions, until the entire mass has cooled and solidified progressively from bottom to top. When solidification is complete, the shrinkage cavity should be substantially full of the heat insulating material. If desired, this heat insulating material may be retrieved and used again in accordance with the method shown and described in my Patent No. 1,719,542, of July 2, 1929.

By the use of my improved means the depositing of the amount of dry insulating material upon the top of the ingot necessary to effect the most efficient solidification of the ingot metal is assured and it is possible to obtain a steady yield of sound and homogeneous ingots. Various modifications in the specific construction of the insulating means and the particular manner of its use disclosed herein by way of example may be made without departing from the spirit of the invention as defined in the claims.

I claim:

1. Portable means for covering the top of molten ingot metal in a mold comprising a quantity of heat-insulating material of sufficient volume to cover the top of the ingot to a depth of at least one-fourth of the minimum cross section of the ingot at its top, and a jacket enveloping said material.

2. Portable means for covering the top of molten ingot metal in a mold comprising a quantity of heat-insulating material of sufficient volume to cover the top of the ingot to a depth of approximately one-half of the minimum cross section of the ingot at its top, and a jacket enveloping said material.

3. Portable means for covering the top of molten ingot metal in a mold comprising a quantity of heat-insulating material of sufficient volume to cover the top of the ingot to a depth of from one-fourth to three-fourths of the minimum cross section of the ingot at its top, and a jacket enveloping said material.

4. Portable means for covering the top of molten ingot metal in a mold comprising a jacket capable of being destroyed by the heat of ingot metal at pouring temperature and containing a measured quantity of finely-divided heat-insulating material of sufficient volume to cover the top of the ingot to a depth of at least one-fourth of the minimum cross section of the ingot at its top.

5. Portable means for covering the top of molten ingot metal in a mold comprising a quantity of heat-insulating and heat-producing materials of sufficient volume to cover the top of the ingot to a depth of at least one-fourth of the minimum cross section of the ingot at its top, and a jacket enveloping said material.

EMIL GATHMANN.