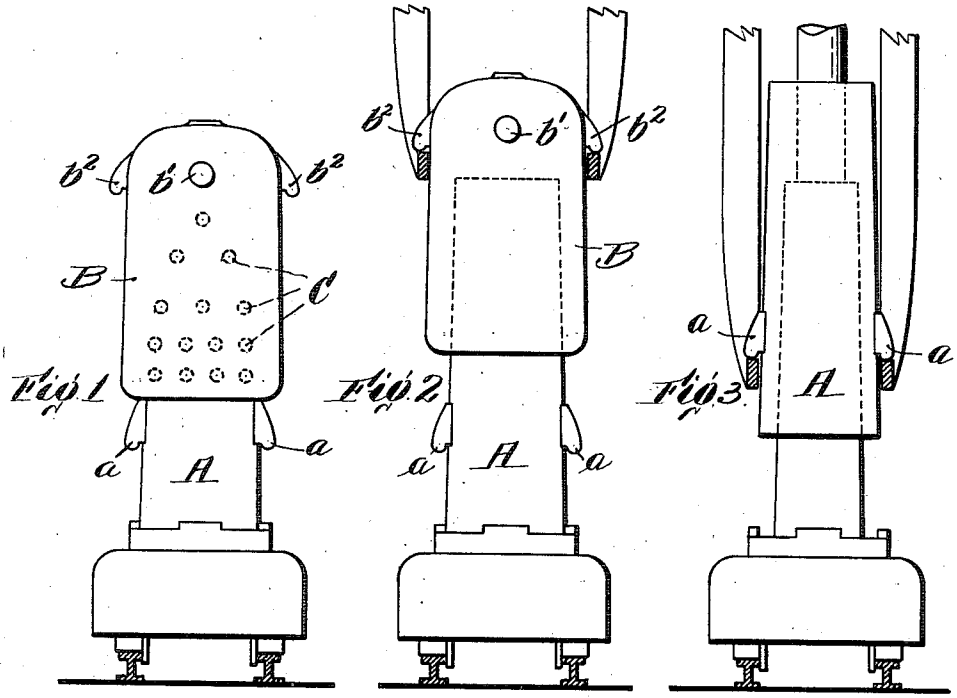
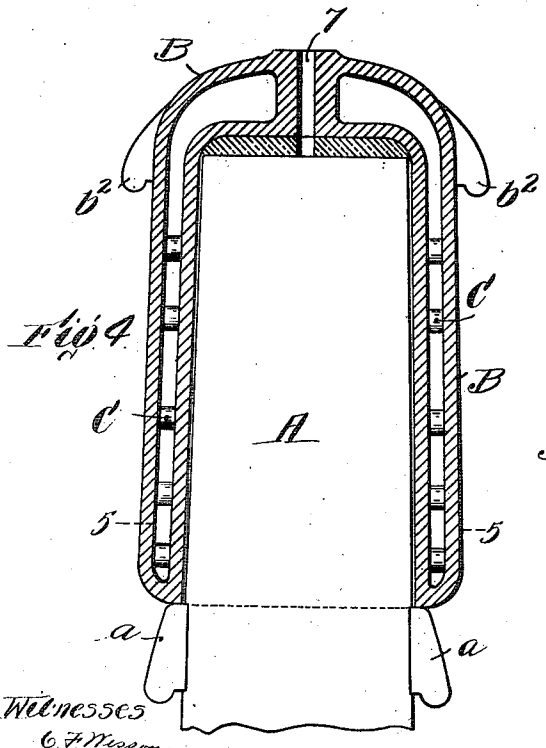
L. W. SOUTHGATE.

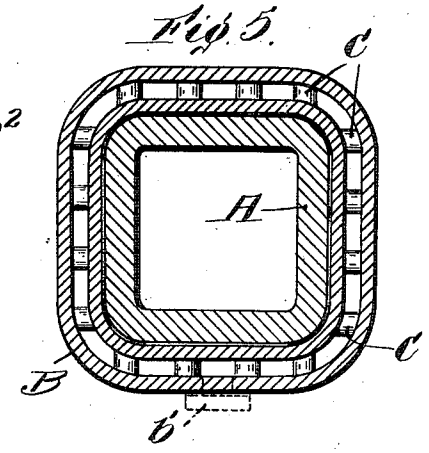
METHOD OF CASTING INGOTS.

APPLICATION FILED OCT. 8, 1907.

964,576. Patented July 19, 1910.







Witnesses
C. F. Mason.
M. E. Regan.

Inventor:
L. W. Southgate
By Attorneys
Southgate & Southgate

UNITED STATES PATENT OFFICE.

LOUIS W. SOUTHGATE, OF WORCESTER, MASSACHUSETTS.

METHOD OF CASTING INGOTS.

964,576. Specification of Letters Patent. Patented July 19, 1910.

Application filed October 8, 1907. Serial No. 396,488.

To all whom it may concern:

Be it known that I, LOUIS W. SOUTHGATE, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Method of Casting Ingots, of which the following is a specification.

In casting ingots, particularly steel ingots, from the Bessemer converter, difficulty is encountered in getting a perfect cast. These ingots are cast on the end. As the metal necessarily cools and sets first at the sides of the mold, the contraction has to take place at the center where the metal is fluid or partially fluid. This causes a funnel-shaped hole to be formed from the top down into the center of the mold, sometimes extending twenty to thirty per cent. of the length of the cast. This is called "piping". The walls of this pipe oxidize as the metal cools and no amount of rolling will weld the pipe and eliminate the imperfection. This necessitates cutting off enough of the upper end of the cast ingot to eliminate this flaw. If the flaw remains in the ingot below what is cut off, an imperfection remains and it may be very serious if the ingot is rolled into rails. This piping occasions loss and risk.

The object of the present invention is to reduce and eliminate, so far as possible, this piping. To do this I proceed as follows: After the mold is poured in the usual way, a cap or jacket is dropped down on top of the mold so as to cover up a considerable portion of the sides and top thereof. This cap is constructed, so far as is possible, to retain the heat in the upper part of the mold and to keep the metal in the upper part of the mold molten for a long time so that as the cast solidifies, the heat of the molten metal will keep the space produced by contraction filled so that no separation can take place. It has been found that a vacuum will almost perfectly prevent dissipation of heat and to utilize this principle, the cap above referred to is made hollow and air exhausted therefrom. This hollow-walled cap, when placed on the top of the mold after the ingot has been poured, will keep the top of the ingot in molten condition. If desired, the action of cooling from the bottom of the mold may be carried up toward the top thereof in a progressive manner, either by arranging the cap so that there will be a dissipation of heat through the same, which dissipation is gradually diminished toward the top, or by gradually raising the cap off of the mold.

The invention will now be described in detail, reference being had to the annexed drawing in which,

Figure 1 is an end view showing the cap in position on a mold. Fig. 2 is a similar view illustrating the progressive raising of the cap. Fig. 3 is a view showing the stripping of the mold from the ingot. Fig. 4 is a sectional view on enlarged scale through the top of the cap or jacket and mold, and Fig. 5 is a cross sectional view taken on the line 5—5 of Fig. 4.

Referring to the drawing and in detail, A designates the mold. These molds are placed on cars usually in pairs for convenient manipulation. The only change that is made in the mold is that the ears *a*—*a* by which the mold is stripped from the ingot are placed at a lower point thereon.

B represents the cap or jacket. This is made in the form of a hollow-walled cap which can fit approximately tightly to the top of the mold and which has depending walls which extend down to cover and protect the sides of the mold the desired degree. This is usually a little more than one-half of the mold. The cap or jacket is provided with an opening which can be tightly closed with a suitable plug *b'*. The cap or jacket is usually made out of cast metal and after casting, the air exhausted therefrom and the opening into the inside of said cap is sealed. The cap or jacket may be provided with a vent 7 for the escape of gas. The cap or jacket is also provided with ears b^2—b^2. The sides of the walls of the jacket which extend down over the upper end of the mold may be connected by cross pieces C, as shown, the number of which, horizontally speaking, will diminish toward the top of the mold, as shown in dotted lines in Fig. 1. The upper end of the cap or jacket is usually provided with a filling of refractory material to prevent the heat of the ingot from melting the wall which goes over the top of the mold.

The invention is carried out as follows: After the mold is cast, the same is run to position where a cap or jacket can be

dropped on the same. This may be conveniently done by the arms of the usual stripper crane engaging under the ears b^2—b^2 of a jacket. After the cap or jacket is in place on the mold, the ingot is allowed to cool. The heat of the ingot will be dissipated out through the lower part of the sides of the mold where the same is not protected by the cap or jacket and the upper part of the ingot will be kept molten by said cap or jacket. This will allow the molten metal to fill up any pipe or hole which may tend to form in the ingot. The cap or jacket will keep the metal molten for the time necessary for this purpose. The progressively diminishing number of bars C will allow the cooling of the ingot to take place up in that part of the mold which is covered by the jacket progressively, so that the cooling will take place as much as is possible progressively up from the bottom of the mold and the top of the ingot will be kept molten as long as is possible. The same effect may be obtained by gradually raising the jacket off of the mold as shown in Fig. 2. The mold is stripped from the ingot by the usual arms of the crane engaging the ears *a*—*a* and drawing the mold off of the ingot while a ram or plunger engages the top of the ingot and keeps the same from lifting, as shown in Fig. 3.

The invention as previously described may be readily worked out so as to be practiced in connection with the ordinary plants and various forms of cranes and devices may be applied for applying and removing the caps or jackets. The caps or jackets are especially well adapted for the purpose described, as owing to the construction of the jacket shown, the loss of heat will be very small. Moreover, as the cap or jacket fits approximately tightly to the mold, loss by convection will be practically eliminated. Moreover, no strain will be put upon the walls of the jacket as the same receives the heat from the mold by reason of any expansion or contraction of the heat insulator which is the vacuum. Many other forms of apparatus may be devised for carrying out my invention without departing from the scope thereof as expressed in the claims.

Having thus fully described my invention, what I claim and desire to secure by Letters-Patent is:—

1. The method of reducing or preventing the formation of a pipe in a metal casting, which consists in insulating the upper part of the mold so that heat dissipation therethrough is checked while the lower part of the ingot cools and the upper part of the ingot is kept molten, and gradually removing the insulation upward.

2. The method of reducing or preventing the formation of a pipe in a metal casting, which consists in locating an external removable heat insulating instrumentality around the upper part of the sides and top of the mold to keep the metal molten at the top of the mold to allow the ingot to cool from the bottom.

3. The method of reducing or preventing the formation of a pipe in an ingot, which consists in placing around the upper part of the mold when the ingot is cooling from a molten state, a jacket which extends down to cover part of the sides of the mold, said jacket having a space from which air is exhausted, whereby the top of the mold will be surrounded by a vacuum.

4. The method of producing ingots, which consists in applying a jacket having a space from which air is exhausted, to the upper part of the mold while the metal is solidifying.

5. The method of producing ingots, which consists in applying a jacket having a space from which air is exhausted, to the upper part of the mold while the metal is solidifying, whereby dissipation of heat from the upper part of the mold is reduced and progressively allowing the dissipation of heat through the protected part of the mold.

6. The method of producing ingots, which consists in applying a jacket having a space from which air is exhausted to a part of the mold while the metal is solidifying.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses.

LOUIS W. SOUTHGATE

Witnesses:
C. FORREST WISSON,
MARY E. REGAN.