C. R. STEWART & G. E. THACKRAY.

INGOT MOLD.

APPLICATION FILED MAR. 19, 1914.

1,235,166. Patented July 31, 1917.

Fig. 1.

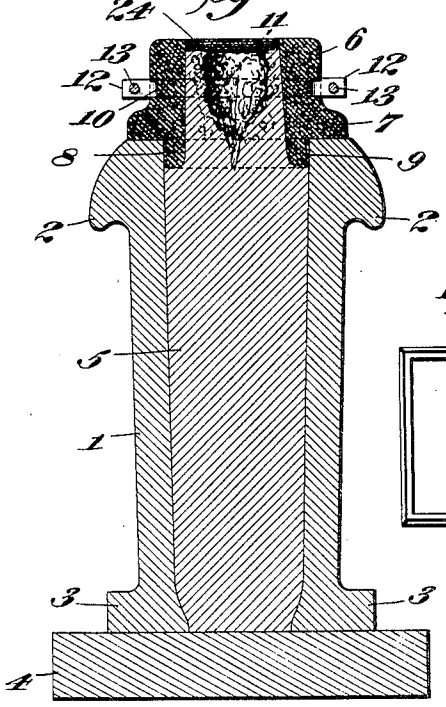


Fig. 3.

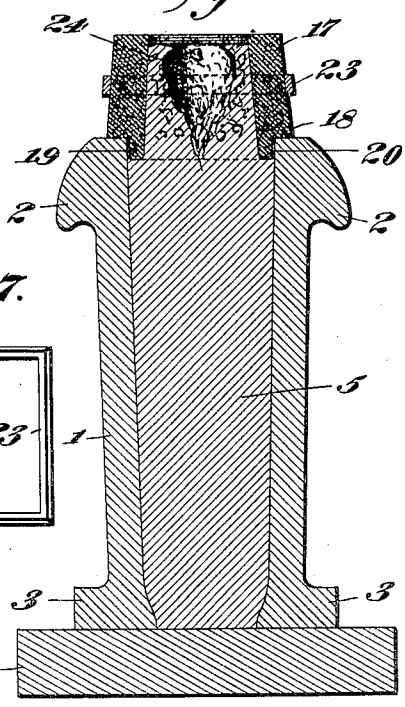


Fig. 7.

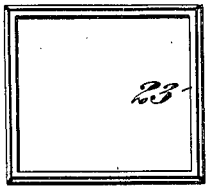


Fig. 2.

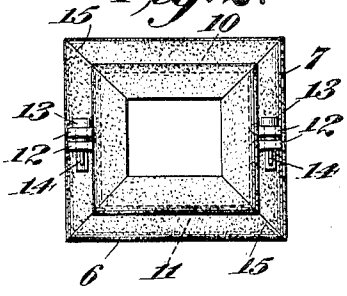


Fig. 8.

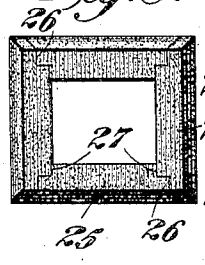


Fig. 4.

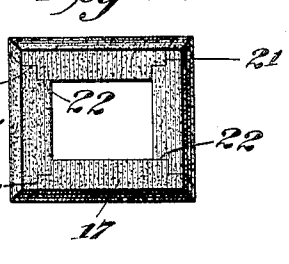


Fig. 5.

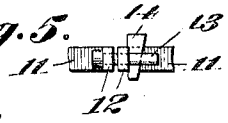
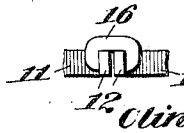


Fig. 6.



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UNITED STATES PATENT OFFICE.

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INGOT-MOLD.

1,235,166. Specification of Letters Patent. Patented July 31, 1917.

Application filed March 19, 1914. Serial No. 825,802.

To all whom it may concern:

Be it known that we, CLINTON R. STEWART, a citizen of the United States, residing in the city of Johnstown, county of Cambria, and State of Pennsylvania, and GEORGE E. THACKRAY, a citizen of the United States, residing in the borough of Westmont, in the county of Cambria and State of Pensylvania, have invented certain new and useful Improvements in Ingot-Molds; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to an improved construction of ingot molds including a top portion of non-conducting refractory material of such a character as to maintain the heat of molten steel or other metal, whereby the part of the ingot adjacent thereto is maintained in a molten condition longer than the other portions, which other portions are adjacent to, or in contact with the conducting portion of the ingot mold itself, which is made of iron, steel or other metal. By this means we maintain the metal in the upper portion of the mold in such a condition of fluidity or plasticity, that as the ingot cools, the molten metal in the upper or sink-head portion feeds the shrinkage which would otherwise cause a hole or so-called "pipe." The pipe or opening is therefore formed only in the sink-head portion, which is preferably of lesser diameter than the mold, and which sink-head portion can be rejected and thrown away without any material loss, as it forms a very small percentage of the entire ingot.

Having thus given a general description of our invention, we will now, in order to make the matter more clear, refer to the accompanying sheet of drawings in which like characters of reference indicate like parts:—

Figure 1 is a vertical cross section of a metal ingot mold and stool fitted with a refractory and non-conducting upper portion.

Fig. 2 is a top plan view of the form of our non-conducting refractory top shown in Fig. 1, this view showing the beveled joints between the sections thereof.

Fig. 3 is a vertical transverse section of another form of our refractory top.

Fig. 4 is a top plan view of the non-conducting refractory top shown in Fig. 2, the joints between the sections of the same being shown as rabbeted or offset as indicated.

Fig. 5 is a detail view of a clamp band secured together by a bolt provided with a slotted hole and a wedge inserted therein.

Fig. 6 is a detail view of another form of securing the bands by means of a horseshoe clamp.

Fig. 7 is a plan view of an integrally formed band illustrated in Fig. 3.

Fig. 8 is a top plan view of our non-conducting refractory top showing a rabbeted joint of slightly different arrangement from that of Fig. 4. In this arrangement the pieces composing the top are all of similar patterns and may either be made all of the same size, or of different sizes, to provide a square or rectangular opening for a sink-head of any given size or proportions.

The upper non-conducting portions of the mold may be composed of brick, fire-brick, or dry sand, either with or without an admixture of preferably fibrous mineral materials, such as asbestos. The refractory or non-conducting top may be made of a comparatively cheap quality of fire-brick which is composed of ordinary fire clays and other refractory materials, molded, dried and then burned to provide the necessary coherence.

Referring now to the characters of reference on the drawings:—

The metal ingot mold is indicated as 1, the top or lifting lugs thereon are indicated as 2, the bottom or holding down lugs are indicated as 3, the stool on which the ingot mold and ingot set is indicated as 4 and 5 indicates the body of the ingot itself.

The form of the non-conducting refractory top illustrated in Fig. 1 is indicated as 6, the sections of which are provided with lateral projections or flanges 7, and with other downwardly projecting flanges or portions 8 which extend slightly into the upper portion of the mold as shown. 9 indicates a slight space or opening between the flange 8 and the upper portion of the inside of the ingot mold, which space or clearance is provided to insure that the refractory top will fit in the mold despite slight irregularities in either, and this space may, or may not, be filled with clay, loam or other material. As, however, this space is small and the conducting surface of the top of the ingot mold is adjacent thereto, the steel or other metal

from which the ingot is formed will not ordinarily flow into this space, but will be chilled and become solid near the very lower edge of said opening.

As shown in Fig. 1, a groove 10 is provided in the sections forming the refractory non-conducting top in which to form a retaining seat for the metal bands 11, which are shown as made in two portions. This groove, however, may be omitted and the metal band may be seated directly on the outer surface of the refractory non-conducting top, or the outer surfaces of said top may be slightly tapered upwardly, in which case a solid band may be driven thereon, as indicated in Fig. 3.

The ends of the metal band 11 are indicated as 12, being bent outwardly from the body portion thereof, as shown, and secured together by the key bolts 13 and the keys 14.

The illustration of Fig. 5 is a side view of the clamp band, similar to that otherwise illustrated in Figs. 1 and 2. The metal clamp band 11 is made in halves, the ends of each half being bent outwardly from the body portion and provided with holes, as illustrated. After the bricks are assembled as illustrated in Figs. 1 and 2, the clamp bands are put around them with the outstanding portions 12 adjacent, bolts 13 are passed through the holes in the outstanding clamp bands, and the key 14 inserted and driven home; thus drawing the halves of the band tightly together and holding the bricks in their proper relative positions.

As shown in Fig. 2, the non-conducting refractory top is shown as composed of four pieces provided with beveled joints 15 on the corners.

An alternate form of clamp band is illustrated in Fig. 6, in which a horse shoe clamp is indicated as 16.

Referring now to Figs. 3 and 4, the non-conducting refractory top is indicated generally as 17, composed of four pieces as shown, this being provided with laterally projecting seat portions 18 adapted to rest on top of the mold, and with downwardly projecting flange portions 19 extending slightly into the upper portion of the mold as shown. A slight space 20 is provided between the downwardly projecting flanges 19 and the adjacent surface of the upper portion of the mold as shown, which space or clearance is similar to that previously described as 9. The sections of the non-conducting refractory top shown in Fig. 3 are provided with rabbeted or offset joints 21 and 22 as shown in Fig. 4, this upper portion being shown as composed of four sections secured together by an integral band 23. The outer portions of this form of top are slightly tapering as shown, so that the integral band can be driven thereon without the need of any further special holding or clamping means.

As shown in Figs. 1 and 3, 24 indicates the opening or pipe formed in the sink-head portion of the mold, which is confined to that portion by the action of our refractory non-conducting top as herein described. The sink-head portion can be left on the ingot as it is rolled, or it can be cut off beforehand, if desired, leaving a solid ingot from which to produce first class material.

It should be noted that the individual pieces composing the top, as shown in Fig. 4, are of substantially the same pattern, although this arrangement may be varied without departing from our invention.

The bricks composing the refractory non-conducting top, shown in Fig. 8, are indicated as 25 and rabbeted joints between the various pieces are indicated as 26 and 27.

It should be noted that the metal ingot mold 1 is shown of tapered form with the small end down and our refractory non-conducting top set on the upper and larger end thereof, but we also wish it understood that our construction is equally adapted for use on the smaller end of an ingot mold which is set with its larger end downward. After molten metal is poured into and fills the mold and substantially fills the non-conducting top portion, after a short interval, a further quantity of molten metal may be supplied thereto before that therein has become set, in order to feed the shrinkage and lessen the cavity. The ingot is preferably kept vertical and may be withdrawn from the mold, or the mold withdrawn from it, in various ways unnecessary to mention herein. After the ingot and the mold are separated the ingot may be charged into an upright soaking-pit furnace, and with the refractory top thereon, in which case it would be preferable to remove the metal band, leaving the refractory non-conducting material on the top. This will keep the top portion hot and permit the shrinkage cavity to form wholly within the same, thus making the body of the ingot solid.

The top construction is such that it may be used many times before it has become worn or broken; its life is increased and it is economically made on account of its sectional character.

If preferred, we may remove the refractory top from the ingot before charging the ingot into the upright soaking-pit furnace, providing its work has been accomplished by that time.

As shown in the various illustrations, the individual pieces of refractory material or bricks which compose our ingot top are made substantially flat or straight, particularly on their inner surfaces and joined together at their edges adjacent to the corners of the mold by a beveled or rabbeted joint. Owing

to this form of construction, when the molten metal is poured into the top portion and heats the same, due to the very high temperature of the metal, the pieces of refractory material, due to natural laws, will expand due to the heat and will expand more in those portions which are the hottest or adjacent to the molten metal. On account of the simple form of our pieces of refractory material or bricks, this expansion may readily take place and is facilitated by the joints at the corners, with the result that the solid portions of the refractory pieces are not cracked, as a movement may take place at the joints. This, therefore, has the result of prolonging the life of a top of this character, so that it may be used many times.

A refractory brick made to inclose a rectangle with joints at the sides thereof, the individual bricks being provided with reentrant angles, is a difficult form to make, which will even crack when drying after being molded and preparatory to burning, and will crack further in the corners when burning, causing a large amount of waste and rejections. In addition to this, a brick of this character when subjected to the heat of molten metal, as above described, will crack irregularly in the reëntrant angles and becomes useless after having been used only once. All of these difficulties are obviated by our simple forms of refractory material or bricks, joined at their edges adjacent to the corners of the mold.

Although we have shown and described our improvements in considerable detail, we do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of our invention, or as pointed out in the claims.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:—

1. An ingot mold top composed of similar sections of refractory non-conducting material joined together at their edges adjacent to the mold corners and forming the entire upper portion of the mold.

2. An ingot mold top composed of similar sections of refractory non-conducting material bevel jointed together at their edges adjacent to the mold corners and forming the entire upper portion of the mold.

3. An ingot mold top composed of similar sections of refractory non-conducting material, joined at their end edges, forming the entire upper portion of the mold, and a clamp band surrounding said sections, adapted to hold them together.

4. A mold top composed of similar sections of refractory non-conducting material each section forming one side of the upper portion of the mold, thereby providing an opening at the upper portion thereof, surrounded by said material.

5. A top for ingot molds comprised of sections of refractory non-conducting material, joined at their end edges, forming the hollow upper portion of the mold, said sections being provided with laterally extending seat portions adapted to rest on the top of the mold, and downwardly extending flanges adapted to project within the upper portion of the inside of the mold, and a clamp band surrounding said sections adapted to hold them together.

6. The combination with a metal ingot mold of a separate top portion mounted thereon, comprised of sections of refractory non-conducting material jointed together at their end edges, forming the hollow upper part of the mold, said sections being provided with laterally extending seat portions, and downwardly extending flanges, said flanges being arranged to project within the upper portion of the inside of the metal mold, and an adjustable clamp band surrounding said sections adapted to hold them together.

7. The combination with an ingot mold, of a feeder resting on the top of the mold and formed in four sections joined at the corners, each of said sections having a downwardly projecting flange or bead at the base extending into the mold, and adjustable means for holding the feeder sections in close contact with each other.

In testimony whereof we hereto affix our signatures in the presence of two witnesses.

CLINTON R. STEWART.
GEORGE E. THACKRAY.

Witnesses:
CYRIL A. RIEVEL,
ELMER SEAVEY.