March 25, 1930. E. S. SAWTELLE 1,752,280

METHOD AND APPARATUS FOR CASTING METAL

Filed July 13, 1928 2 Sheets-Sheet 1

Fig. 1.

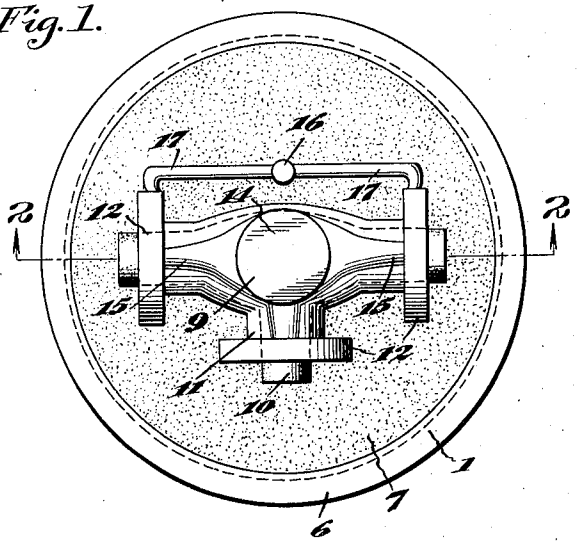


Fig. 3.

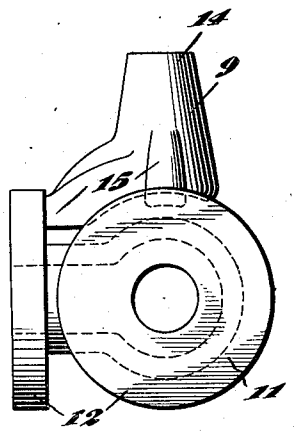


Fig. 4.

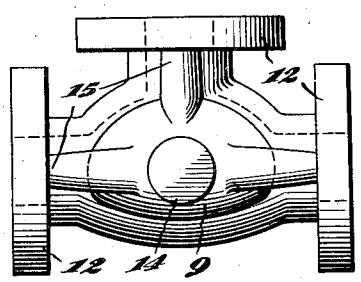
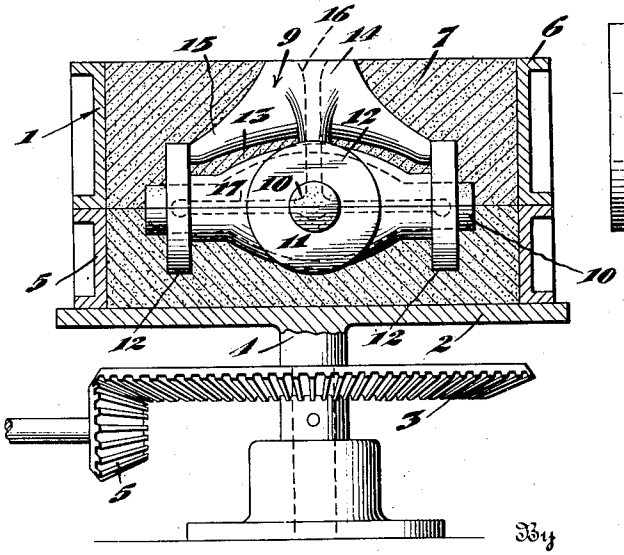


Fig. 2.



Inventor

Elmer S. Sawtelle

By Wood & Wood

Attorneys

March 25, 1930. E. S. SAWTELLE 1,752,280

METHOD AND APPARATUS FOR CASTING METAL

Filed July 13, 1928 2 Sheets-Sheet 2

Fig. 5.

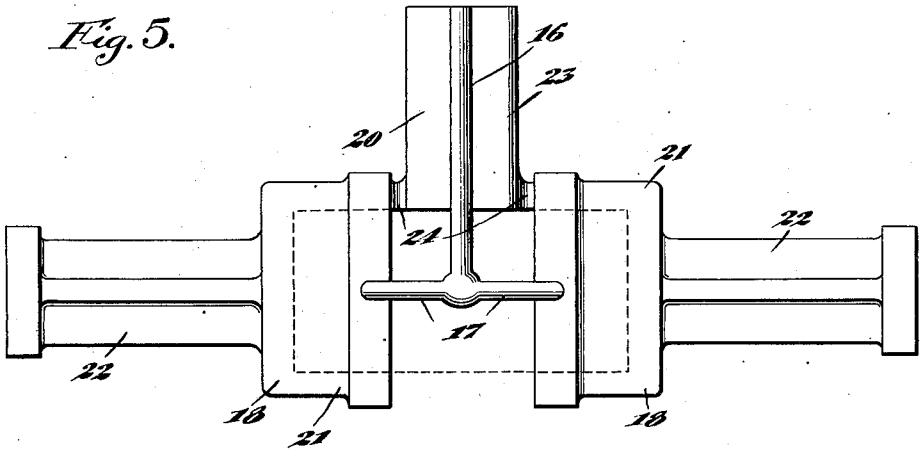
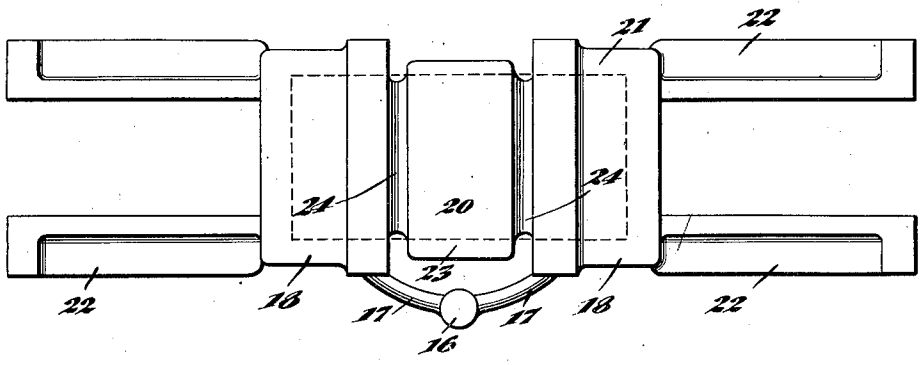


Fig. 6.



Inventor

Elmer S. Sawtelle

By Wood & Wood

Attorneys

Patented Mar. 25, 1930 1,752,280

UNITED STATES PATENT OFFICE

ELMER S. SAWTELLE, OF CINCINNATI, OHIO, ASSIGNOR TO THE SAWBROOK STEEL CASTINGS COMPANY, OF LOCKLAND, OHIO, A CORPORATION OF OHIO

METHOD AND APPARATUS FOR CASTING METAL

Application filed July 13, 1928. Serial No. 292,427.

This invention relates generally to the art of casting metal and is particularly directed to an improved method of casting and an apparatus for use in the method.

It is of extreme importance in many castings that the metal be entirely free of shrink holes and pits and that certain heavy sections of the casting be extremely dense so that these sections may be subsequently ground down or faced to accurate dimension without encountering holes or pores which would render the casting unfit for use.

The present invention resides in the combination, use and construction of a novel form of mold for forming a riser extrinsic of the article mold cavity, the riser having any number of snouts or extensions leading out from its lower end to the flanges or parts of the casting in which density is especially required and to which more metal must be directed than to other given areas.

Broadly speaking, the present improvement, in addition to the apparatus now in use, is in the above described riser which may be shaped and disposed within the sand in any desired relation to the mold for an efficient disposition of the metal, the metal in the riser generating pressure at the required points due to its weight. It is also possible to so dispose the element of the present invention in such relation to a given number of molds to be filled as to achieve the proper directing of the molten metal and the resultant density in a number of individual castings, the molds thereof being disposed radially of the riser.

This invention, therefore, provides a formed riser of this nature providing a head pressure chamber located above the casting cavity, the molten metal preferably being delivered directly into the mold cavity and rising into the head chamber through radial ancillary passageways extending upwardly from those portions of the mold forming the heavy sections of the casting. The result achieved is that the lighter sections of the casting cool first, shrinkage therin is compensated for by the supply of metal from the heavy sections under head pressure, and the heavy sections cooling under the gravity action induced by the weight of the metal within the head pressure chamber are supplied for shrinkage, from the ancillary passageways, the metal in the head chamber cooling last, being of greater quantity and thickness. Delivering the metal to the article molding cavity causes the rising metal to carry any particles or gases up into the riser.

The use of centrifugal action in the casting method and apparatus herein disclosed has been found especially adaptable and it is preferred in the use of the apparatus disclosed in the foregoing description. The centrifugal force in the present instance is applied to generate pressure in the heavy sections of the casting through extrinsic conduits or passageways leading from a heavy head of metal. This centrifugal force is directly applied from the center of the head pressure chamber by rotating the mold on a center coincident with the head pressure chamber or riser body and is exerted through radial passageways, packing the heavy sections and insuring dense casting therein.

It is, therefore, an object of this invention to provide an improved method of casting, the method being adapted to the formation of castings having extremely heavy, irregular peripheral portions.

It is another object of this invention to provide an improved apparatus for casting articles of metal and to provide a pattern element for use therein for forming ancillary casting channels of unique arrangement, the principle in the use of which is the same in all instances only necessitating an arrangement and formation of the element to suit the given article to be cast and in result to provide an improved method of casting through the use of the apparatus described in general.

Still another object is to provide an improved method and apparatus for forming metal castings which is especially adapted for centrifugally generating relatively great casting pressures at various points in the castings being formed.

Other objects and certain advantages will be more fully set forth in a description of the accompanying drawings, forming a part of this specification, in which;

Figure 1 is a top plan view of the casting apparatus showing a completed casting, the upper cope flask being removed.

Figure 2 is a sectional view taken on line 2—2, Figure 1, illustrating the completely formed casting formed within the molding apparatus and mounted on a table for revolving the mold, the riser portion of the mold being shown in its cast form prior to removal from the casting body.

Figures 3 and 4, end view and plan view respectively, illustrate the formed casting removed from the mold.

Figures 5 and 6, side and plan views respectively, illustrate an arrangement of the riser relative to a plurality of articles to be cast for directing the metal to the respective flanges thereof, the casting being disposed radially of the axis of rotation or center of the riser.

The castings shown in the disclosure of the drawing made by this method and apparatus are in some instances valves and in others valve yokes, formed of steel. For this type of article it is especially desirable that density be procured in the casting, these castings being adapted for high pressure duty and since the flanges must be faced or ground to accurate dimension it is requisite that there be no pockets or cavities in the flanges.

As disclosed in Figures 1 and 2, the mold, indicated at 1, is mounted on a rotating table 2, this table being revolved by means of a bevel gear 3 pinned to the central standard 4 thereof, and driven by means of a bevel pinion gear 5.

The mold, constructed according to the usual foundry practice, comprises a circular flask formed in two pieces connected on a horizontal joint, the lower thereof referred to as the drag flask 5 and the upper as the cope flask 6.

The flask has the respective sand molds formed therein indicated at 7, and the sand packed or rammed in the usual manner around a pattern.

As shown in Figures 1 and 2, the sand of the cope flask is formed around a riser pattern. The views may be treated as showing the casting immediately after formation and prior to removal from the mold, the riser being filled with metal and indicated at 9. Means for clamping the respective mold halves together is not shown herein but may be of any conventional type. The core, constructed in the usual manner and inserted after the patterns are drawn from the sand, is indicated at 10. The core is shown in diagrammatic form since it forms no part of this invention.

The casting shown in Figures 1 and 2 is that of a valve, being generally indicated at 11. This valve provides a body having thin walls suitably cored out, and an attaching flange at the ends of each of the respective passageways of the valve, these flanges being indicated in each instance at 12. The flanges are of considerably greater relative thickness as compared to the body walls, and being attaching flanges are of much greater diameter, than the connecting valve body portions, consequently requiring a greater amount of metal.

In the molding operation illustrated in these views, a core indicated at 13 may be set between the riser and the article cavity after the riser pattern is withdrawn from the upper or cope flask, or the riser pattern may be sectional for withdrawal without disturbing the sand wall between the riser and the article cavity when the sand is packed around both the riser pattern and the article pattern and fills the space therebetween dispensing with a core.

The riser, as formed, comprises a head pressure chamber of relatively large dimension indicated at 14, and radially extending snouts or ancillary passageways 15 extending downwardly and outwardly from the head pressure chamber portion, connecting to each flange region of the article mold cavity.

Molten metal is poured directly into the mold cavity through a pouring gate or passageway 16 extending downwardly through the cope flask to the joint of the mold and forked to extend along the joint to each end of the mold cavity as indicated at 17.

With the respective cavities formed and the cores set, the molten metal is poured into the mold, rising upwardly through the interior of the article mold cavity, upwardly through the ancillary passageways, filling the head pressure chamber. When the casting is small the pouring through the article mold cavity is continued until the metal levels with the top of the riser, but in casting larger pieces this pouring is discontinued prior to the levelling and molten metal then is introduced through the riser to fill the same. This latter method provides a head of hotter metal, cooling exceedingly slow due to the quantity, and precluding any possibility of the head of metal cooling first which is essential as outlined hereafter. Immediately after pouring ceases, the entire mold is rotated rapidly through the medium of the gears until the molten metal sets or cools.

The effect of the centrifugal action is to fling the metal outwardly from the head pressure chamber into the flange portions under considerable pressure, this centrifugal action being aided by the weight of the metal within the riser. Shrinkage in the casting is compensated for in the following manner.

The body walls of the casting cool very rapidly, but since the pressure is being generated in the flanges, metal is supplied to the body to take care of shrinkage therein. The centrifugal action induced by the rotation of

the mold, inasmuch as the article cavity and the riser are centrally disposed on the mold and, therefore, are directly on the axis of rotation, tends to force the metal outwardly to the irregular peripheral portions of the casting. This would seem at first observation to also fling the metal from the center of the article, but this action is prevented by the pressure centrifugally generated in the flanges aided by the weight of the metal in the riser. The greatest pressure generated is in the flanges, this being the result sought, inasmuch as the metal in the flanges must be extremely dense for facing operations as hereinbefore stated.

The flanges as they cool, draw their supply for shrinkage from the ancillary radially or laterally disposed passageways of the riser, and the large head pressure chamber of the riser cools last since it has the greatest mass of metal therein. After the crude article is removed from the mold, the respective cores are removed and the riser section of cast metal is cut away from the article. It will be understood that if a sufficient head of metal is used in the riser the weight thereof will force the molten metal to the desired regions and shrinkage will be compensated for in the same manner as aforesaid. The cast article as drawn from the mold in its crude form is illustrated in Figures 3 and 4.

Figures 5 and 6 illustrate a method and apparatus for casting a plurality of castings 18 by the use of the present invention. The mold and the rotating table are not shown, the table being of sufficient diameter to support a flask large enough to contain a plurality of castings radially disposed from a center or axis of rotation.

The riser used in this instance is indicated at 20, being shown in the form of a cast portion joined with the crude castings. The pouring of the metal as in the other cases is directly into the article mold cavity. The articles to be cast, as shown in this instance, are valve yokes, this type of casting having a heavy flange and body portion indicated at 21 at one end thereof, and feet 22 extending outwardly from the heavy flange and body portion of the casting.

The riser, mounted on the axis of mold rotation, comprises the head pressure portion indicated at 23 and the laterally extending snouts 24, these snouts connecting to the flange portions of the casting.

Although only two castings have been shown in these views, it is readily understood that any number may be radially disposed from the riser head pressure chamber and fed from respective laterally disposed snouts.

Having described my invention, I claim:

1. A casting apparatus, comprising, a rotatable mold having a mold cavity formed therein, said cavity having regions of relatively greater cubical dimension, said mold having a head pressure chamber formed on its axis of rotation above said mold cavities, and a plurality of ancillary supply passageways extending from the head pressure chamber to the mold regions of relatively greater cubical dimension.

2. In a casting apparatus, a mold, means for revolving said mold, the molding cavity of said mold providing outwardly disposed regions of greater cubical dimension than the central or main portion of the cavity, said mold having a riser cavity formed therein, said cavity disposed on the axis of mold rotation, and having radially disposed snout extensions leading to said outwardly disposed zones of the mold cavity, and means for supplying the metal to be cast directly into the molding cavity.

3. A rotary casting apparatus, comprising, a mold having an article molding cavity formed therein, means for rotating said mold on a center coincidental with the center of said mold cavity, said mold having a pouring gate entering said article molding cavity and a riser cavity centrally disposed relative to and in communication with the peripheral regions of the article mold cavity.

4. A casting apparatus, comprising, a rotatable mold having a cavity formed therein, said cavity disposed on the axis of mold rotation and having outwardly disposed regions of greater cubical dimension, a pouring gate for said mold entering directly into the mold cavity, said mold cavity having a head pressure chamber, located on the axis of mold rotation, formed therein, and lateral passageways extending to the article mold cavity regions of greater cubical dimension.

5. A molding apparatus, comprising, a rotatable mold having a molding cavity formed therein providing regions of relatively greater cubical dimension, and a chamber for containing a source of ancillary supply located on the axis of mold rotation and in communication with each region of greater cubical dimension through individual passageways, and means for feeding the metal into the mold.

6. A rotary casting apparatus, comprising, a mold having an article molding cavity formed therein, means for rotating said mold, said mold having a pouring gate entering said article molding cavity and a riser cavity in communication with the atmosphere and with the peripheral regions of the article mold cavity.

7. A casting apparatus, comprising, a rotatable mold having an article cavity formed therein, said cavity having outwardly disposed regions of greater cubical dimension, a pouring gate for said mold, said mold having a head pressure chamber, located on the axis of mold rotation, formed therein, and lateral passageways extending to the article

mold cavity regions of greater cubical dimension.

8. A molding apparatus, comprising, a mold having a molding cavity formed therein providing regions of relatively greater cubical dimension, and a chamber for containing a source of ancillary supply located above and having individual passageways in communication with each region of greater cubical dimension, and means for feeding the metal into the mold.

9. A casting apparatus, comprising, a mold having a mold cavity formed therein, said cavity having regions of relatively greater cubical dimension, said mold having a head pressure chamber formed above said mold cavity, and a plurality of ancillary supply passageways extending from the head pressure chamber to the mold regions of relatively greater cubical dimension.

10. The method of making castings having irregular but relatively massive peripheries, said method, comprising, pouring the molten metal into a mold, filling a riser portion of the mold cavity extending above and radially connecting with the portions of the mold of largest cubical content, rotating the mold with the axis of rotation disposed through the riser of metal, whereby the molten metal is forced downwardly and outwardly to the portions of the mold of largest cubical content.

In witness whereof, I hereunto subscribe my name.

ELMER S. SAWTELLE.