(No Model.) 2 Sheets—Sheet 1.

H. G. UNDERWOOD.

METHOD OF AND APPARATUS FOR CASTING.

No. 533,686. Patented Feb. 5, 1895.

Fig. 1.

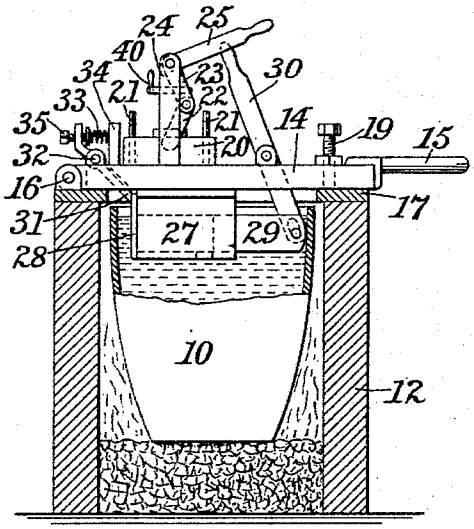

Fig. 2.

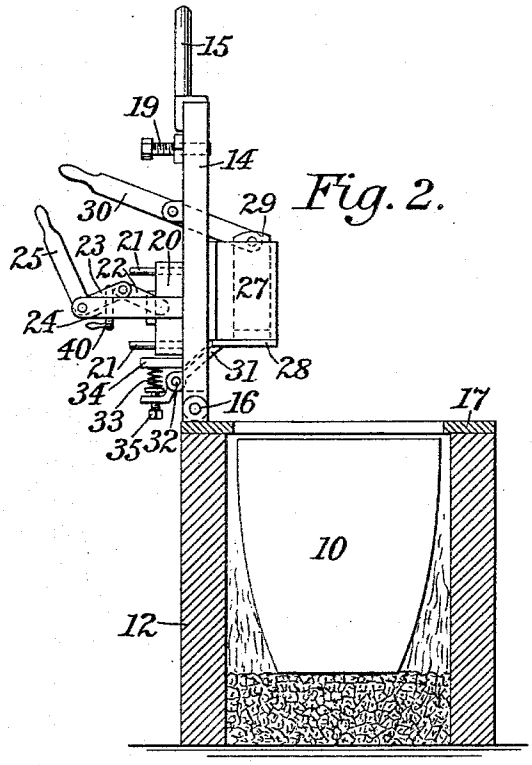

Fig. 3.

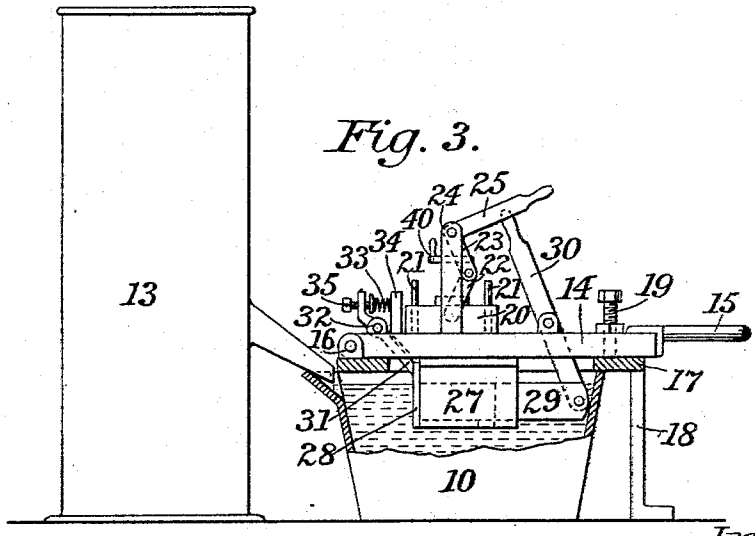

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Fig. 4.

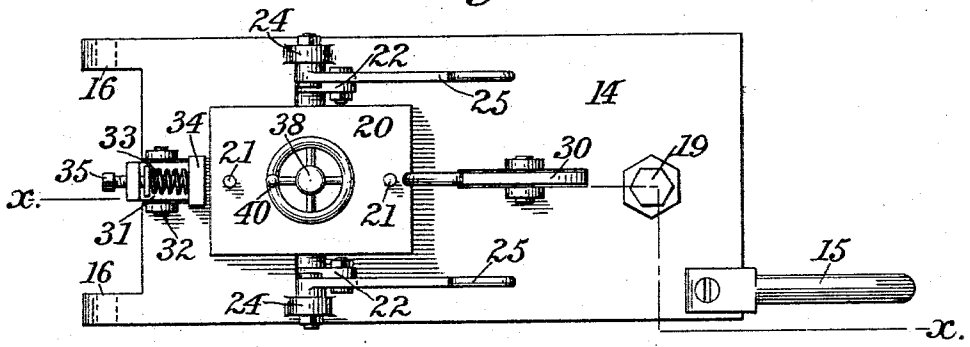


Fig. 5.

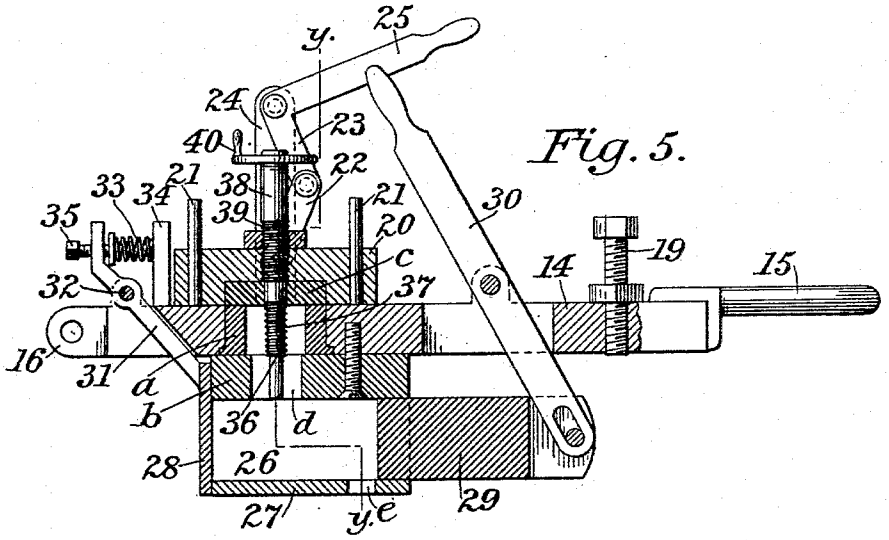
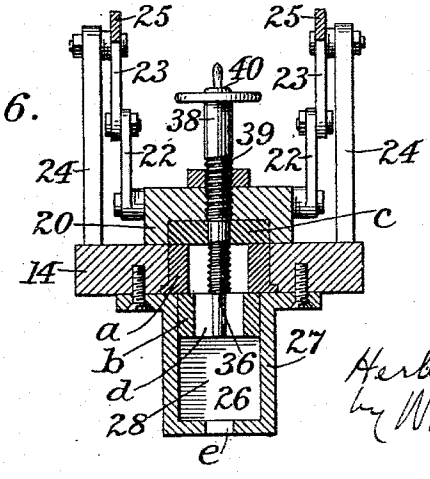


Fig. 6.



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METHOD OF AND APPARATUS FOR CASTING.

SPECIFICATION forming part of Letters Patent No. 533,686, dated February 5, 1895.

Application filed August 31, 1893. Renewed August 30, 1894. Serial No. 521,686. (No model.)

To all whom it may concern:

Be it known that I, HERBERT G. UNDERWOOD, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Casting; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, making a part of this specification.

This invention relates particularly to the molding or casting of small articles which it is desired should come from the mold practically in a condition for use without needing to be finished in the usual manner. It will be apparent, however, that the invention is not restricted in its application to the production of small articles except so far as the weight of the articles and the consequent and proportionate weight of the apparatus renders manipulation practically impossible.

The object of the invention is to produce an improved method of casting and improved apparatus therefor.

The improved method may be described as consisting in forcing the molten material into the mold through an open side of the mold under a uniform pressure, maintaining the pressure on the molten material and separating the molten material, while still under pressure, in the plane of the open side of the mold by causing a solid body, which virtually forms one side of the mold, to be passed across the mouth of the ingate or open side of the mold while the molten material is still under pressure, thereby not only preventing the escape of any of the molten material from the mold before it has hardened, but at the same time removing all superfluous material from the mold and leaving that side of the molded article which corresponds to the ingate or open side of the mold in a smooth and finished condition. The practice of this method will be more readily understood from the description of the apparatus which is set forth hereinafter, the novel features of the apparatus being set forth in the claims.

In the accompanying drawings, Figure 1 is a side elevation of the apparatus shown as in place over a melting pot of soft metals, the latter being partly broken out and the furnace being shown in vertical section. Fig. 2 is a similar view, showing the apparatus turned back from the melting pot for the more convenient removal of the article from the mold. Fig. 3 is a view chiefly in elevation illustrating the use of the apparatus for molding articles of hard metal. Fig. 4 is a top view of the apparatus shown in Figs. 1 and 2, on a larger scale and removed from the melting pot. Fig. 5 is a vertical section of the apparatus on the line x—x of Fig. 4. Fig. 6 is a vertical section of the same on the plane of the line y—y of Fig. 5.

I have represented in the drawings a convenient form of apparatus in which the improved method may be practiced, but it will be understood that I do not intend thereby to place any restriction upon the novel method which I have invented nor do I intend thereby to limit my invention, so far as the apparatus is concerned, to the exact arrangement shown, the arrangement and general relation of parts varying more or less with the nature of the metal which is used for casting and of the articles to be cast and according to the intended place or mode of use of the apparatus.

In Figs. 1, 2 and 3 of the drawings I have shown the apparatus in conjunction with a pot 10 to contain the molten material. In Figs. 1 and 2 this pot is represented as placed within a furnace 12, while in Fig. 3 it is represented as adapted to receive its charge of molten material from a cupola or other melting furnace 13.

The mold in which the article is to be formed is adapted to be supported over the pot of molten material, preferably in such a manner as to permit of its movement toward and away from the pot for the purpose of permitting the article to be removed from the mold, and also in such a manner as to permit of the adjustment of the mold and the parts connected thereto with reference to the surface of the molten material. The support 14 which I have represented in the drawings as adapted for this purpose consists of a bar or plate having a handle 15 at one end and at the other having a loose connection, such as a hinged joint 16, with a ring or table 17 which rests upon the upper edge of a furnace, as shown

in Figs. 1 and 2, or upon legs 18, as indicated in Fig. 3.

Various means for adjusting the support 14 relatively to the surface of the molten metal in the pot, so that certain parts which are preferably attached to the support may be submerged beneath the surface of the molten material in the pot as the quantity of such material is diminished, will readily suggest themselves, but when the support is hinged at one end, as represented, I prefer to tap a bolt 19 into the outer end of the support so that the lower end of the plate may contact with the ring or table, whereby the rotation of the bolt or screw will raise or lower the support and mold.

The mold which is supported by the plate 14 may be of any desired shape, according to the form of the article to be molded. I have represented in the drawings a mold adapted for the production of a nut with an apertured top or cap. For this purpose the body *a* of the mold is fixed in the support 14, while the lower portion *b* of the mold is a separate piece which is screwed upon the under side of the support 14. The top or side *c* of the mold is fixed in a side piece 20 which, as indicated, is adapted to be pressed tightly against the support 14 and to be moved away from the same to permit the molded article to be withdrawn from the mold. As represented, the side piece 20 is guided by pins 21 and is connected by links 22 to the arms 23 of bell crank levers which are pivoted on fixed standards 24 mounted on the support 14. The other arms 25 of the bell crank levers constitute handles by means of which the operator may raise or lower the side piece 20. It will be observed that the arrangement of the links and bell crank levers which is represented in the drawings permits the top or side piece *c* to be pressed firmly against the body of the mold and yet to be removed quickly therefrom whenever it is desired.

Upon the under side of the support 14 is formed a chamber 26 which communicates directly with the mold through the open side *d* of the same. Whatever may be the form of the mold I prefer that there shall be no intermediate passage or conduit between the chamber 26 and the interior of the mold, but that the opening of commnnication between the two shall be an open or blank side of the mold itself, in order that all superfluous material may be removed in the manner hereinafter referred to and no projecting portions be left to be removed subsequently from the molded article. However, it will be evident that so far as the practice of my invention is otherwise concerned an intermediate conduit might be interposed between the chamber and the interior of the mold. The chamber referred to may be conveniently formed by securing a casing 27 to the under side of the support 14, one end of the casing being preferably closed by a yielding gate 28 while the other is adapted to permit a plunger 29 to be moved back and forth freely through the chamber 26. The plunger may be operated in any convenient manner, as by a lever 30, which is pivoted to the support 14. As the plunger is drawn back, into the position represented in Fig. 5, when the lower side of the casing 27 is beneath the surface of the molten metal in the pot, the molten metal will enter the chamber through an aperture *e* which is left in the casing for that purpose near the end of the chamber. As the plunger is moved forward across the aperture *e* the molten material within the chamber will be forced through the opening *d* into the interior of the mold and will fill the same completely under a pressure which will depend upon the freedom with which the molten material can escape from the chamber 26. If the fit of the plunger within the chamber is loose, more or less metal will escape between the plunger and the walls of the chamber, but in order that the pressure at which the mold is filled may be controlled I prefer to close the opposite end of the chamber, or some other orifice in the walls of the chamber independent of the intake *e* and of the opening *d*, by a yielding gate or valve 28. As represented in the drawings this gate is supported by a bar 31 which is pivoted at 32 to the support 14. A spring 33 exerts its pressure upon the bar 31 in such a manner as to hold the gate or valve closed until the pressure is sufficient to overcome the tension of the spring. As represented in the drawings the spring is placed between the free end of the bar 31 and a fixed piece 34 while an adjusting screw 35 may be tapped into one or the other to control the pressure at which the gate or valve shall be allowed to open.

The opening *d* between the chamber and the interior of the mold should be disposed about midway of the length of the chamber, or at least so far from the rear end of the chamber that the plunger may move transversely across the opening and close the same completely. The top or side of the plunger should be so shaped as to give the required form to that side of the molded article which corresponds to the opening *d* and it will therefore be clear that as the plunger moves toward and transversely across said opening, not only will the metal be forced into the mold but all superfluous metal will be wiped off by the plunger, leaving the corresponding side of the molded article in a smooth and finished condition. It will also be apparent that until the plunger has closed the aforesaid opening completely the molten metal in the mold will be retained under pressure, thereby preventing the running out of the metal and insuring the complete filling of the mold. It is to be observed further that by providing the yielding gate or valve at the end of the chamber 26 to permit the escape of the molten material and by leaving the open side of the mold to be closed by the side of the plunger two very important results are

secured. In the first place, when it has been determined what degree of pressure upon the molten material in the mold is best under the conditions imposed by the nature of the metal used, by the form of the mold, or by anything else, and the pressure on the gate has been regulated accordingly, that pressure will be uniform throughout each and every operation and will not be increased or decreased in any degree whatever during any part of the operation; and in the second place, it will be possible to completely empty the chamber 26 at each operation, leaving no material therein to become reduced in temperature and in turn to reduce the temperature of the next charge. These results are of special importance in casting articles of irregular shape and having parts which are quite thin, for uniformity of pressure and temperature are then essential in order to secure uniform results and to prevent the spoiling of many castings in the mold.

As stated above, the form of mold which I have chosen for illustration is adapted for the production of a screw-threaded nut and my invention relates in part to the novel mechanism which I have devised for the purpose of producing screw-threaded nuts and other similar articles with facility and accuracy. The core 36 which would be used ordinarily for the purpose of forming a smooth or unthreaded hole in a blank for a nut is formed in this case with a screw-thread of the pitch which it is desired that the thread of the nut shall have and has also a shank 38 which is extended through the side of the mold, the shank and the hole through the side of the mold being formed with screw-threads of the same pitch as that which the thread of the nut is to have. If desired, the extended shank of the core may be provided with a handle 40 for convenience in manipulation. In the use of this part of my improved apparatus the nut or other article is molded about the core in the usual manner and as soon as the metal has set sufficiently to retain its form the shank of the core is rotated in such a direction as to withdraw the core from the mold. Since both the shank and the core are threaded at the same pitch it will be obvious that the core will be withdrawn without stripping the threads of the molded article, even though the metal may not have become thoroughly cooled and hard. In this way not only will the molded article be drawn out of the mold with a smooth and sharp thread, but it may be removed from the mold almost immediately after its formation and without waiting for the metal to cool to any considerable extent.

The operation of the apparatus in the formation of articles of any kind, whether screw-threaded or not, will be readily understood without further description. It may be added that inasmuch as the plunger and the casing within which it moves are at every operation dipped below the surface of the molten material in the pot, to a greater or less extent as determined by the adjusting means referred to, it is desirable that they shall be made of some refractory material. However, the selection of the material for this or other parts of the apparatus as well as the form and arrangement of the apparatus as a whole will be determined in each case according to the nature of the article to be molded and of the material from which it is to be formed. Particularly do I desire it to be understood that the novel method of casting which is set forth herein is not dependent upon the form of apparatus which has been shown and described. I am aware that heretofore a plunger has been passed through a mold and outward through the ingate thereof for the purpose of removing the superfluous metal. Such a method of casting I do not seek to lay claim to herein. In my method the plunger is not moved through the mold nor through the ingate thereof but is moved transversely across an open side of the mold and when in position across such open side it becomes itself a portion of the mold and forms the corresponding surface of the molded article. Furthermore, the movement of the plunger toward and across the opening forces the metal into the mold and maintains it under pressure therein, thereby preventing the escape of any of the molten material from the mold and at the same time removing from the open side of the mold all superfluous material. The result is that the molded article conforms in all parts to the formation of the mold itself and is removed therefrom in a practically finished condition.

I claim as my invention—

1. The herein described method of casting which consists in introducing a limited quantity of the molten material into a chamber, forcing the molten material from said chamber into the mold through an open side of the same under uniform pressure, maintaining pressure on the molten material, separating the molten material while still under pressure in the plane of the open side of the mold, thereby cutting off the superfluous material and leaving the corresponding side of the molded article in a finished condition, and finally expelling all the superfluous material from the chamber; substantially as and for the purpose described.

2. The herein described method of casting which consists in submerging a chamber in a mass of molten material, introducing a quantity of the molten material into the chamber, forcing the molten material from said chamber through the side of a communicating mold under uniform pressure, maintaining the pressure on the molten material, separating the molten material while still under pressure in the plane of the open side of the mold, thereby cutting off the superfluous material and leaving the corresponding side of the molded article in a finished condition, and finally expelling all the superfluous material

from the chamber; substantially as and for the purpose described.

3. In an apparatus for casting, the combination of a support for a mold, a chamber communicating with said mold through a lateral opening corresponding to one side of the molded article, a plunger having a sliding fit in said chamber and movable transversely across said opening whereby the molten material is forced into the mold, the superfluous material is removed by said plunger and the side of the article corresponding to said opening is left in a finished condition, and means to permit the escape of the molten material from the chamber beyond said opening; substantially as shown and described.

4. In an apparatus for casting, the combination of a support for a mold, a chamber communicating with the mold through a lateral opening corresponding to one side of the molded article, said chamber also having an independent orifice beyond said opening, a plunger having a sliding fit in said chamber to force the molten material into the mold and movable across said opening, and a yielding valve covering said orifice and opening outwardly to permit the molten material to be forced out by the movement of the plunger beyond the mold; substantially as shown and described.

5. In an apparatus for casting, the combination of a support for a mold, a chamber communicating with said mold through a lateral opening corresponding to one side of the molded article, said chamber also having an independent orifice beyond said opening, a plunger having a sliding fit in said chamber to force the molten material into the mold and movable across said opening, an outwardly opening valve closing said orifice, and means to regulate the pressure upon said valve, whereby the pressure at which the molten material is forced into the mold may be controlled; substantially as shown and described.

6. In an apparatus for casting, the combination of a support for a mold, a chamber attached to said support and communicating with the mold, a plunger movable in said chamber and adapted to force the molten material into the mold, a pot for the molten material, and means to adjust the position of said support with respect to said pot whereby said chamber and plunger may be submerged always beneath the surface of the molten material as the quantity of such material is diminished; substantially as shown and described.

7. In an apparatus for casting, the combination of a movable support carrying a mold, a chamber suspended beneath said support and communicating with the mold, a plunger movable in said chamber independent of the mold but adapted to force the molten material into the same, and means for operating said plunger, whereby the casting apparatus may be moved into a pot of molten material to receive its charge and may be moved away from the same to permit the mold to be opened; substantially as shown and described.

8. In an apparatus for casting, the combination of a movable support, carrying a mold, a chamber suspended beneath said support and communicating with the mold, a plunger movable in said chamber independent of the mold but adapted to force the molten material into the same and forming when retracted an end of the chamber, and means carried by said movable support for operating the plunger; substantially as shown and described.

9. In an apparatus for casting, the combination of a pivoted support, a chamber suspended beneath said support and communicating with the mold, a plunger movable in said chamber and adapted to force the molten material into said mold, and a lever for operating said plunger secured at one end thereto, and pivotally secured to the said support; substantially as shown and described.

10. In an apparatus for casting, a support for the mold, a chamber attached to said support, opening at the top into the mold and having an opening in its under side for the admission of the molten material, a plunger sliding in said chamber and forming when retracted an end of said chamber, and a yielding gate at the opposite end through which in the forward movement of the plunger the superfluous material is expelled; substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HERBERT G. UNDERWOOD.

Witnesses:
A. N. JESBERA,
A. WIDDER.