H. L. WHITTEMORE.

PROCESS OF METAL CASTING.

APPLICATION FILED MAY 14, 1910.

1,002,889. Patented Sept. 12, 1911.

2 SHEETS—SHEET 1.

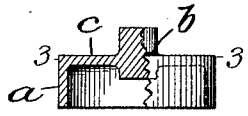

Fig. 1.

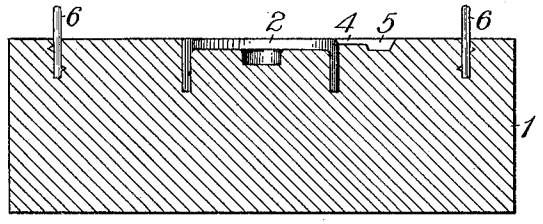

Fig. 2.

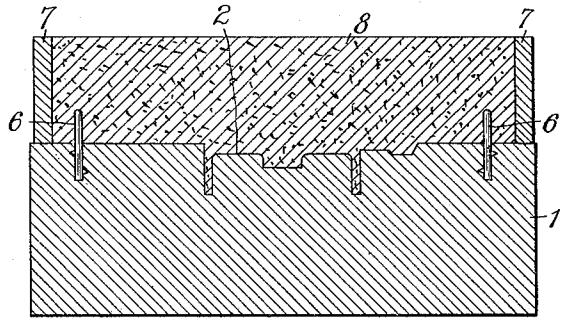

Fig. 3.

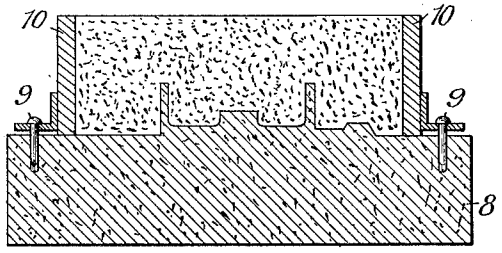

Fig. 4.

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2 SHEETS—SHEET 2.

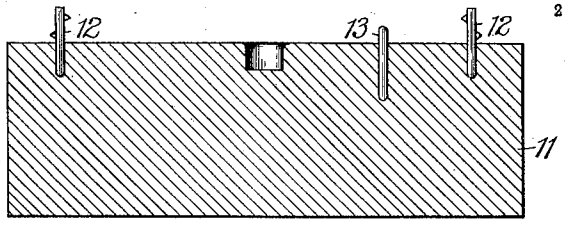

Fig. 5.

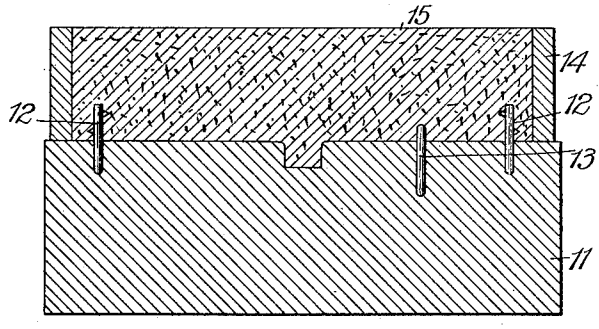

Fig. 6.

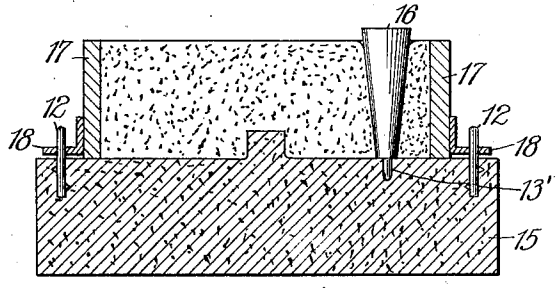

Fig. 7.

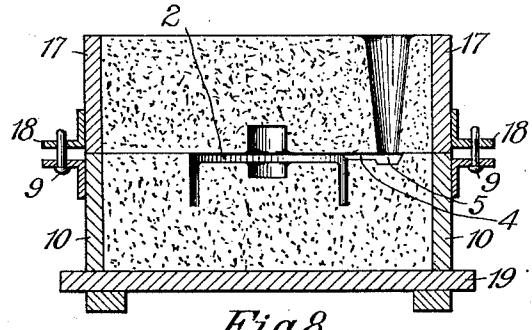

Fig. 8.

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UNITED STATES PATENT OFFICE.

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PROCESS OF METAL-CASTING.

1,002,889. Specification of Letters Patent. **Patented Sept. 12, 1911.**

Application filed May 14, 1910. Serial No. 561,291.

To all whom it may concern:

Be it known that I, HERBERT L. WHITTEMORE, a citizen of the United States, residing at Urbana, in the county of Champaign and State of Illinois, have invented a certain new and Improved Process of Metal-Casting, of which the following is a clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention consists in an improved process of metal casting.

It involves a combination of steps commencing with a form used in making the pattern continuing with the formation of the pattern itself and concluding with the making of a sand mold into which the molten metal is poured.

In accordance with the improved process of my invention a form is first made of a suitable plastic material, of which paraffin wax is the best example known to me. Paraffin is easily melted. It may be readily cut or shaped by means of tools and it hardens at ordinary temperatures so as to maintain the shape which is given to it in the forming process. This wax form thus produced is in the shape of an intaglio of the article to be cast. The surface of the paraffin in which the intaglio is formed is preferably conformed also to duplicate the gate and parting surface of the mold which ultimately is to be made from the finished pattern. When the form has been completed hydraulic cement, or concrete of hydraulic cement is placed in the intaglio of the article to be cast and of the gate thus to make a pattern not only of the article to be cast but preferably also of the gate and parting surface of the mold. When the concrete sets or hardens there results a hard durable pattern which is a reverse of the sand mold into which the molten metal is to be poured in casting. The pattern duplicates not only the article to be cast but also the gate or gates leading from the sprues or risers and also the parting surface of the mold. When the pattern has hardened sufficiently it is removed from the form and by means of suitable registering devices, such as dowels and dowel pins, it is made to occupy the desired position in the flask into which the sand is tamped to form the sand mold. If the article to be cast lies entirely upon one side of the parting surface, an intaglio of the whole of the article to be cast will be cut in one form. The pattern in this case having been brought into register with the drag of the flask will serve to form the sand which is then tamped into the drag to conform with the article to be cast except that the parting surface of the cope must have a plane surface to come into juxtaposition with the parting surface of the sand of the drag, and this plane surface may be formed against the plane molding board or against the plane pattern of concrete as may be preferred. If on the other hand the article to be cast lies partly on either side of the parting surface, a separate pattern is required for each portion of the mold. In a two-part mold a second portion will be made in the manner above described with respect to the portion of the pattern which is used in the drag. This second pattern will be cast in concrete from a wax form which is cut into an intaglio of the portion of the article to be cast which extends above the parting surface of the mold and thus into the cope of the flask. The cope pattern is brought into register with the cope of the flask in the same way that the other portion of the pattern is brought into register with the drag. Molding sand is then tamped into the cope to form the cope portion of the mold. The two portions of the mold when completed are brought into register by means of dowels or other registering devices to form a complete sand mold into which the molten metal to be cast is poured. These and the other features of my invention will be more clearly understood by reference to the accompanying drawings in which—

Figure 1 shows partially in side view and partially in cross section the article to be cast. Fig. 2 is a sectional view of an intaglio of the portion of the article shown in Fig. 1 located below the parting surface. Fig. 3 is a sectional view of the intaglio shown in Fig. 2 with the concrete in place to form a pattern corresponding with the intaglio shown in Fig. 2. Fig. 4 is a cross sectional view through the pattern shown in Fig. 3 showing the drag of the flask in place upon the pattern to make the portion of the mold corresponding with this portion of the pattern. Fig. 5 shows in cross sectional view an intaglio of a portion of the article to be cast shown in Fig. 1 above the parting line. Fig. 6 is a cross sectional view of the intaglio shown in Fig. 5 in use to

form the corresponding pattern in concrete. Fig. 7 is a cross sectional view of the pattern shown in Fig. 6 in use to form the corresponding portion of the mold in the cope of the flask. Fig. 8 is a view of the assembled cope and drag shown in Figs. 7 and 4 which together constitute the completed mold.

Similar numerals refer to similar parts throughout the several views.

As shown in the drawings the article to be cast is a small pulley having an overhanging rim *a* and a hub portion *b* projecting on either side of a web *c* as indicated in Fig. 1. It will be understood, of course, that the article to be cast may have holes or other parts for which the mold is to be cored. The illustration of such complications is, however, unnecessary to the complete understanding of my invention by those skilled in the art.

The first step in the process consists in forming as much of an intaglio of the article to be cast as lies upon one side of the parting surface that is to be made in the mold. This form is made in a block of paraffin wax which, by means of suitable tools, is cut to form an intaglio of the portion of the article lying upon say the drag side of the parting surface of the mold. The formation of this intaglio may be accomplished partly by melting the paraffin with hot tools if such a method of working is convenient to the making of the particular form required, or it may be done by hand or machine tools such as chisels, gouges, drills, milling machine, shaper, etc. In the present instance the block is preferably mounted upon the face plate of a lathe and the intaglio 2 is formed by turning out with suitable tools the conformation of that portion of the article shown in Fig. 1 which is below the parting line 3—3. After this is done a gate 14 is formed terminating in an enlarged portion 5 which is to occupy a position in the completed mold at the bottom of the sprue hole. Dowel pins 6 are secured in the block 1 to effect a suitable registry between the drag of the flask and the pattern to be made from the intaglio 2.

The completed form 1 has placed upon it in the second step of the process a box 7 into which concrete of hydraulic cement is poured and compacted when in plastic or semi-fluid condition thus to form a pattern 8. Reinforcing wires or rods may be embedded in this concrete to give stiffness to narrow or slender ledges or parts of the pattern or to stiffen the body of the pattern 8. This pattern may also be given the requisite strength by making it somewhat thicker than would be required for the purposes of the pattern alone. After being filled into the box 7 and the depressions of the form 1 the concrete is left until it has set so as to retain the formation of the intaglio 2. The box 7 is then removed and the pattern 8 is removed from the form 1 as a result of which that portion of the article below the parting line 3—3 of Fig. 1 is reproduced in the pattern 8 together with the gate for the mold to be made from the pattern. The surface of the pattern 8 which surrounds the outlines of the article to be cast is adapted to form the parting surface of the mold. Dowel pins 6 form holes in the pattern 8, these being adapted for engagement by registering dowel pins 9 carried by the drag 10 of the flask as shown in Fig. 4.

Not only is a form made for the casting of the drag portion of the pattern but a form and concrete pattern are in like manner made to correspond with the portion of the article which is molded in the cope. This form 11 is illustrated in Fig. 5, it being apparent that there is cut in this form an intaglio corresponding with the portion of the article of Fig. 1 which lies above the parting line 3—3. This form 11 has also placed in it pins 12 upon which to register the cope of the flask, when placed upon the pattern. A pin 13 is also placed in the form as shown in Fig. 6 in order to locate the sprue in forming the cope of the mold.

When the form 11 is finished a box 14 is placed upon its upper surface as shown in Fig. 6 and this is filled with concrete in plastic condition. When the concrete has hardened the box 14 like the box 7 may or may not be removed as is preferred. The concrete pattern 15 is, however, removed from the form 11, the pins 12 in this case being retained in the pattern. The pin 13 is removed from the pattern 15 so as to leave a centering opening or hole for the pin 13′ carried at the lower end of the sprue former 16 as shown in Fig. 7.

After the patterns have become thoroughly hard and dry they are adapted for use in making the sand molds. I have found that a concrete of hydraulic cement is given a very hard and smooth surface when cast in contact with a form of paraffin wax. It is an easy matter to give the wax intaglio a smooth glossy finish and the smoothness and evenness of this surface is imparted to the concrete pattern itself. Furthermore the pattern is easily separated from the wax form. Should any of the paraffin of the form cling to crevices of the pattern the application of slight heat will melt the wax so that it may run off the pattern.

Fig. 4 shows the drag 10 of a flask in register with the pattern 8. The drag is then filled and tamped with moist molding sand in the usual way. The bottom is struck off flush with the bottom edge of the flask 10, a molding board is applied and the pattern and drag are together turned over when

the pattern may be drawn from the drag leaving this portion of the mold complete. In like manner the pattern 15 for the cope part of the mold is placed upon the floor as shown in Fig. 7. The cope 17 of the flask is applied as shown, the pins 12 being brought into register with the brackets 18 and the sprue former being placed in proper position upon the center formed in the concrete pattern. The cope 17 is then filled with molding sand which is tamped into place. The sprue former 16 is then withdrawn. The cope filled with sand is lifted from the pattern, or if necessary the cope with the pattern may be turned over upon the floor and the pattern lifted from the top of the cope after which the cope is placed upon the top of the drag as shown in Fig. 8 the two being brought into register with one another by means of the dowel pins 9 and the brackets 18 as shown.

The completed mold with its flask is placed upon the board 19 when the mold is ready for the molten iron or other metal to be poured to complete the casting operation.

While I have described my invention in connection with the particular materials and arrangements herein disclosed, I do not, however, limit myself to these precise details, but desire to claim broadly any equivalent steps which may suggest themselves to those skilled in the art.

What I claim is:

1. The process of metal casting which consists in cutting in paraffin wax an intaglio of the article to be cast, filling the intaglio with a concrete of hydraulic cement in fluid or plastic condition, causing the concrete to set to form a hard pattern, removing the pattern from the wax intaglio, surrounding the pattern with tamped molding sand in a suitable flask, drawing the pattern from the sand mold, closing the mold and pouring into it the molten metal to be cast.

2. The process of metal casting which consists in first carving an intaglio of the article to be cast, filling the intaglio with concrete in plastic condition, causing the concrete to set to form a pattern, removing the pattern from the intaglio, ramming a mold of molding sand in contact with the said pattern, drawing the pattern from the sand mold, and pouring the mold with molten metal.

3. The process of metal casting which consists in first forming in paraffin wax an intaglio of the portion of the article to be cast together with a parting surface, similarly forming in paraffin wax a second intaglio of another portion of the article to be cast and a corresponding parting surface, filling each of the intaglio wax forms with concrete in a plastic state to cover both the intaglio and the parting surface of each form, causing the concrete to solidify to form sectional patterns, removing each sectional pattern from its wax intaglio, ramming the drag of a flask with molding sand in contact with one of the sectional patterns, ramming the cope of the flask with molding sand in contact with the other sectional pattern, drawing the sectional patterns from the drag and the cope respectively, bringing the cope and the drag of the flask into register with each other, the parting surface of the cope being brought into contact with the parting surface of the drag, and pouring the sand mold with metal to be cast.

4. The process of metal casting which consists in first carving an intaglio of the article to be cast in a block of wax, the surface of the block corresponding to the parting surface of the mold to be formed, casting a concrete pattern and block in contact with said wax block and intaglio, preparing a drag of molding sand from said pattern and block, carving an intaglio of the article to be cast above the line of the parting surface in a block of wax, the surface of this second block corresponding to the parting surface of the mold to be formed, molding a concrete pattern and block by means of this second wax block, preparing a cope of molding sand from said second-named pattern and block, associating said cope and drag to form a mold, and pouring molten metal into said mold.

In witness whereof, I hereunto subscribe my name this sixth day of May, A. D. 1910.

HERBERT L. WHITTEMORE.

Witnesses:
JAMES W. WEBBER,
T. B. WEBBER.