Dec. 9, 1924. 1,518,190

H. EMERY

METHOD OF CASTING HOLLOW WARE OF ALUMINUM

Filed June 11, 1923 2 Sheets-Sheet 1

Fig. 1.

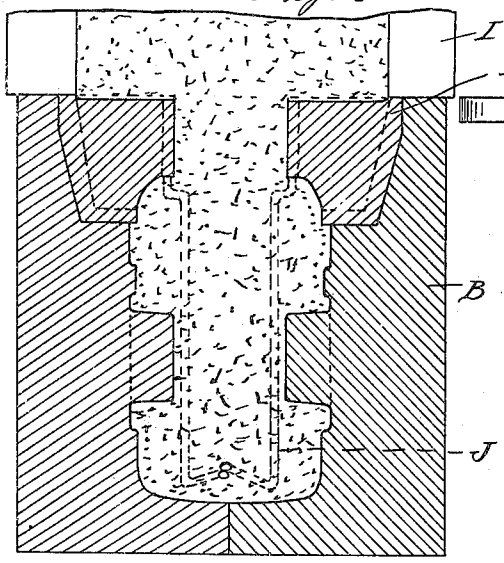


Fig. 2.

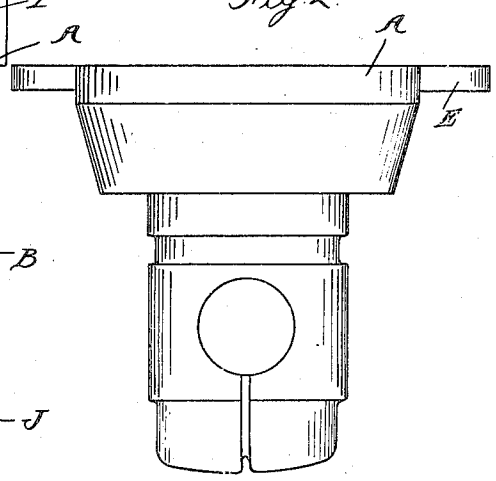


Fig. 4.

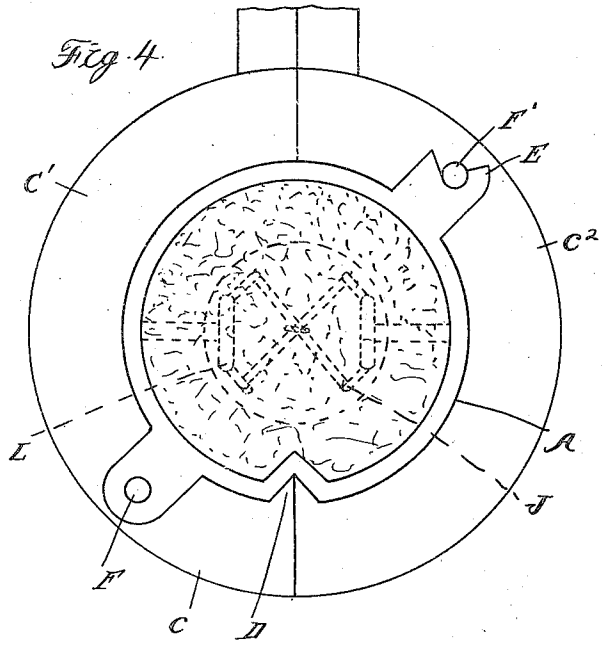
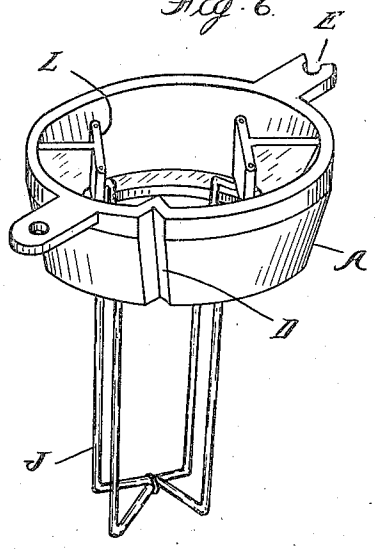


Fig. 6.



Inventor

Howard Emery

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METHOD OF CASTING HOLLOW WARE OF ALUMINUM

Filed June 11, 1923 2 Sheets-Sheet 2

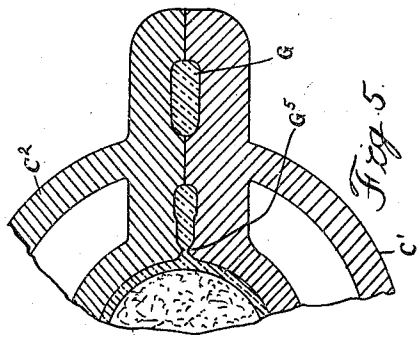


Fig. 5.

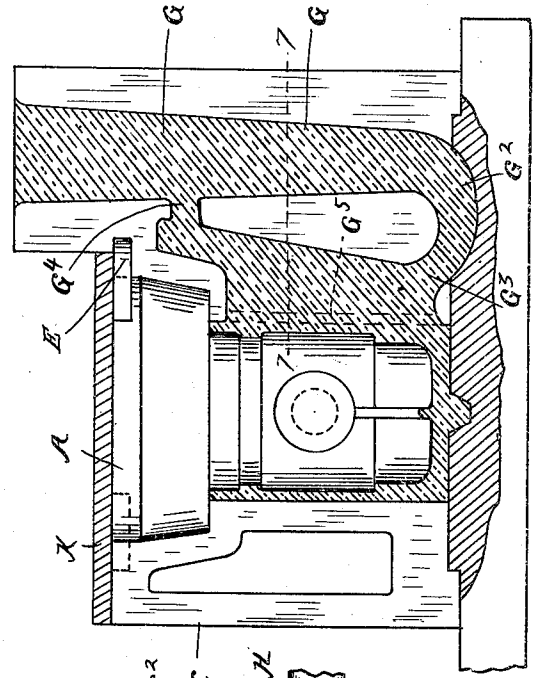


Fig. 7.

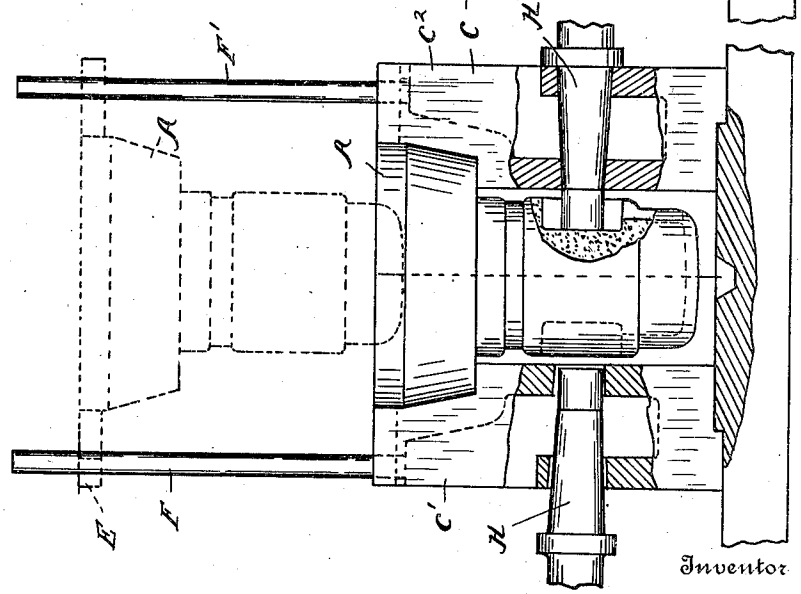


Fig. 3.

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UNITED STATES PATENT OFFICE.

HOWARD EMERY, OF DETROIT, MICHIGAN, ASSIGNOR TO THE CHAS. B. BOHN FOUNDRY CO., OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

METHOD OF CASTING HOLLOW WARE OF ALUMINUM.

Application filed June 11, 1923. Serial No. 644,700.

To all whom it may concern:

Be it known that I, HOWARD EMERY, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Methods of Casting Hollow Ware of Aluminum, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to the casting of hollow articles of aluminum and its alloys and has more particular reference to the manufacture of aluminum pistons for internal combustion engines. It is the object of the invention to obtain a uniform high grade product by a process employing mechanically made molds and eliminating, to a large extent, skilled manual operations. To this end the invention consists in the process as hereinafter set forth.

In the drawings:

Figure 1 is a vertical central section showing the manner of forming the green sand core;

Figure 2 is an elevation of the core supported from its arbor;

Figure 3 is a vertical central section illustrating the manner of guiding the core and its arbor into engagement with the casting mold;

Figure 4 is a plan view thereof;

Figure 5 is an elevation of one section of the casting mold;

Fig. 6 is a perspective view of the arbor;

Figure 7 is a cross section on line 7—7 of Fig. 5.

In the present state of the art articles cast from aluminum and its alloys have been produced both in sand molds and metallic molds. With the latter process difficulty has been encountered in obtaining a satisfactory product, due to the difference in the coefficients of expansion of the aluminum and metal of the molds. Particularly in the casting of hollow articles, such for instance as pistons, and with the use of metallic cores, there is danger either of leaving the metal too long in the mold and causing it to crack or withdrawing it too soon before completely solidified. The margin of temperature and of time intervals is so small that a high degree of skill is required to obtain a satisfactory product. Another difficulty is to introduce the molten metal into the mold with sufficient rapidity and to maintain it under a sufficient hydrostatic head without subsequently injuring a casting through the contraction or drawing of the sprue or gate. As it well known, there is a tendency for molten metal in cooling to contract towards the center of mass and where the sprue or gate which supplies the metal to the mold is of considerable mass, it will exert a drawing effect upon the portion of the casting adjacent thereto. My improved method overcomes these difficulties, first, by substituting a mechanically produced green sand core for a collapsible metallic core; second, by an improved construction or arrangement of sprue or gate, and, third, by various modifications which facilitate the rapid performance of the process.

More in detail and as shown in the drawings, my improved process comprises; first, the forming of a green sand core and securing the same to a supporting and locating arbor; second, the placing of said core within a sectional metallic outer mold which is maintained at the proper temperature and which is provided with a properly fashioned sprue or gate cavity; third, filling the mold with molten metal; and, fourth, in releasing the casting from the metallic mold. The use of the green sand core eliminates all danger of cracking of the casting regardless of the length of time the metal may remain in contact therewith.

The green sand cores are preferably formed in a machine which impacts the sand in the core box or core mold by pneumatic pressure. It is, however, necessary that the core when formed should be accurately located within the outer mold and it is equally important that it be introduced without striking the sides of the mold or anything else that might break or injure it.

To accomplish such results the arbor A is preferably of a conical annular form adapted to engage corresponding conical seats in the core mold B and outer piston mold C. The member A is further provided with a locating lug D for engaging corresponding recesses in the seats B and C, whereby the core is exactly positioned within the mold cavity.

To guide the core while it is being transferred from the core mold to the piston mold, the arbor A is further provided with

an apertured ear E for engaging a guide pin F projecting upward from the mold C and a lug diametrically opposite said ear for engaging a second guide pin F'. The pins F and F' are detachably held in position by engaging sockets in the mold C so that after the core is guided into said mold, the pins may be withdrawn. The outer mold C is formed of separable sections C' and C^2, meeting in the plane of the axis of the piston, and these sections are provided with lateral extensions for the sprue cavity G. This, as specifically shown, has a main channel portion G' which extends below the bottom and has the return-bend G^2 through which the metal rises in a channel G^3 parallel to the side of the piston. The channel G^3 is also cross-connected at its upper end by a channel G^4 with the main channel G', and between the channel G^3 and the mold cavity there is a portion G^5 of restricted width, which facilitates breaking off of the sprue. The construction just described is, however, only one of many constructions that might be used, the essential feature of which is that the flow of the molten metal into the mold cavity is controlled and the solidification of the metal in the sprue is delayed until the metal in the mold cavity is congealed.

Where the piston is formed with inwardly projecting apertured lugs for the wrist pin bearings, the mold sections C' and C^2 have opposite apertures through the side walls thereof through which metal core pins H may be inserted. These pins extend into the mold cavity in the outer mold and also into a depression in the core, which forms the lug, and the arrangement is such that the pins may be withdrawn as soon as the metal is set and before the opening of the sections of the outer mold.

With the parts constructed as described, the process of forming a piston or other hollow article is as follows: The arbor A is first placed in the core mold B and the latter registered with the pneumatic sand impacter, indicated at I. When the air pressure is turned on, the sand is projected through the center of the arbor with such impact that it completely fills all portions of the core mold cavity with sand at the required density. Loop-shaped anchors J depending from the arbor A are embedded in the sand and impart the required tensile strength to the core while it is suspended from the arbor.

As soon as the core is formed, the mold B is removed from the impacting machine and opened, the arbor A being lifted by the workman and transferred into a position in alignment with the casting mold C. This as before described is provided with the upwardly projecting guide pins F and F', one of which engages the apertured ear E in the arbor, while the other forms a cooperating guide by which the core is accurately centered in axial alignment with the casting mold. Thus the operator in lowering the core into said mold can guide the arbor A to its seat without danger of striking the sides of the mold or injuring the core. The guide pins F and F' are then withdrawn, the cover plate K is placed on the mold C and the pins H are inserted through the opposite sides of the mold into the mold cavity. The molten metal is then poured through the sprue G, filling the mold cavity and solidifying therein in advance of solidification in the sprue. The pins H are almost instantaneously withdrawn before contraction of the metal will cause the overstressing of the same, after which the metal may remain in the mold for any length of time without injury. However, to increase the output the casting is quickly removed from the mold, the arbor is detached and returned to the core machine. The outer mold sections are then preferably cleaned by an air blast and are closed in readiness for the reception of another core and the repetition of the casting process.

The delay in the solidification of metal in the sprue until after the casting is solidified is effected partly by the relative masses in the mold cavity and in the sprue cavity and also by the preheating of the mold adjacent to the sprue cavity through the play of a gas flame thereon.

The arbor A is preferably formed of greater diameter than the mold cavity and is tapered so as to freely enter the recess in which it is seated. There are also provided inwardly projecting lugs L shown as of substantially T-shaped form, which form bearings for the attachment of the anchor J and also finger holes for the convenience of the workman in transferring the arbor from the impacting machine to the casting mold.

What I claim as my invention is:

1. The process of forming hollow castings of aluminum and like metals, which consists in first forming a green sand core upon an arbor, engaging said arbor with a seat therefor in an outer mold, whereby the core is suspended within the mold cavity of said outer mold and in filling the mold cavity with the molten metal.

2. The process of forming hollow castings of aluminum and like metals, which consists in first impacting a green sand core in anchored relation to a supporting arbor, engaging said arbor with a seat therefor in a preheated sectional mold, and filling said mold with molten metal through a sprue cavity provided therein and in which the molten metal is maintained fluid until after the solidification of adjacent metal in the mold cavity.

3. The process of forming hollow castings of aluminum or like metals, which consists in first impacting a fashioned green sand core in a mold cavity and in anchored relation to an arbor for supporting the same, transferring said arbor and core to a preheated sectional outer mold, guiding said core and arbor in axial alignment with the outer mold and lowering the same into a seat for the arbor which holds the same accurately positioned axially and rotatively, and filling the mold cavity with molten metal through a sprue connection, maintaining the metal fluid therein until after the congealing of adjacent metal in the mold cavity.

4. The process of forming hollow castings of aluminum and like metals, which consists in mechanically impacting a green sand core in a fashioned mold cavity and in anchored relation to an arbor for supporting the same, transferring said arbor and suspended core into axial alignment with the mold cavity of a preheated sectional outer mold having a seat for said arbor, lowering said arbor into engagement with its seat, whereby said core is suspended within said mold cavity, filling the mold with molten metal and through a sprue of sufficient dimensions to quickly fill the mold cavity and to maintain the metal fluid within said sprue until after the solidification of adjacent metal in the mold cavity, removing the casting from the mold and detaching the arbor and returning the same to receive another core.

5. A mold for the casting of hollow articles of aluminum or like metals comprising an arbor for supporting a green sand core and a sectional outer mold provided with a seat for receiving said arbor with the core suspended therefrom within the mold cavity.

6. An apparatus for the forming of cast articles of aluminum or like metals comprising a mold for a green sand core provided with a seat for receiving a core supporting arbor, an arbor for engaging said seat, core anchors depending from said arbor within the core mold cavity, and a sectional outer mold having a corresponding seat for said arbor and for holding the core suspended therefrom accurately positioned within the mold cavity.

7. An apparatus for the forming of cast articles of aluminum and like metals comprising a mold for the forming of a green sand core, an arbor for supporting the core seated upon said mold and provided with means for accurately positioning the same with respect thereto and an outer casting mold having a seat for receiving said arbor, and corresponding means for positioning the same with the core suspended in accurate registration within the mold cavity.

8. An apparatus for forming cast articles of aluminum and like metals comprising a mold for a green sand core having a tapering arbor receiving seat, an arbor for engaging said seat provided with means for accurately positioning the same in relation to the mold cavity and also provided with a projecting anchor around which the sand is impacted, a sectional outer casting mold provided with a seat for receiving said arbor corresponding to the seat in said core mold and adapted to accurately position the green sand core within the mold cavity.

9. An apparatus for forming castings of aluminum and like metals comprising an annular arbor, having a substantially unobstructed opening therethrough, a core mold for receiving said arbor provided with means for accurately positioning the same, an anchor depending from said arbor within the mold cavity and around which the sand entering through said annular arbor is impacted, and a casting mold for receiving the arbor and its depending core provided with corresponding means for accurately positioning the same.

10. An apparatus for forming cast articles of aluminum and like metals, comprising an arbor, means for forming a green sand core supported from said arbor, a casting mold, and guiding means on said casting mold engageable with said arbor to accurately register the core with the mold cavity and to guide the same therein.

11. An apparatus forming cast articles of aluminum and like metals, comprising an arbor, means for forming a green sand core depending from and supported by said arbor, a casting mold having a seat for receiving said arbor, guiding means on said casting mold for engaging said arbor to hold the core in accurate registration with the mold cavity during the engagement of said arbor with its seat, said guiding means being detachable from said mold after the seating of the arbor.

12. An apparatus for forming castings of aluminum and like metals comprising an arbor, means for forming a green sand core depending from and supported by said arbor, a casting mold having a seat for said arbor, a guide rod projecting upward from said casting mold, an apertured lug on said arbor for engaging said guide rod to hold the core in alignment with the mold cavity during the seating of said arbor, said guide rod being detachable from said mold subsequent to the seating of the arbor.

13. An apparatus for forming cast articles of aluminum and like metals, comprising an annular arbor of greater diameter than the mold cavity and provided with an inwardly extending lug, an anchor secured to and depending from said lug, means for forming a green sand core depending from said arbor and embedding said anchor, and

a casting mold having a seat for receiving said arbor and for holding the core accurately positioned within the mold cavity.

14. The combination with a metallic mold having a seat therein, of an arbor having a complementary portion for engaging said seat and depending anchors extending therefrom, said arbor being provided with an opening adapted for admitting green sand for impounding a green sand core about said anchors.

15. The combination with a metallic mold having a seat therein adjacent the mold cavity, of a metallic ring having a complementary portion for engaging said seat, loop shaped anchors secured to said ring and dependent therefrom, said ring having an aperture therein sufficient to admit sand therethrough for impounding a green sand core around said anchors.

16. A metallic support for a green sand core comprising an annulus having conical side walls, a flange extending inwardly therefrom and having an aperture therethrough, loop shaped wire anchors supported by said annulus and extending through said aperture.

In testimony whereof I affix my signature.

HOWARD EMERY.