

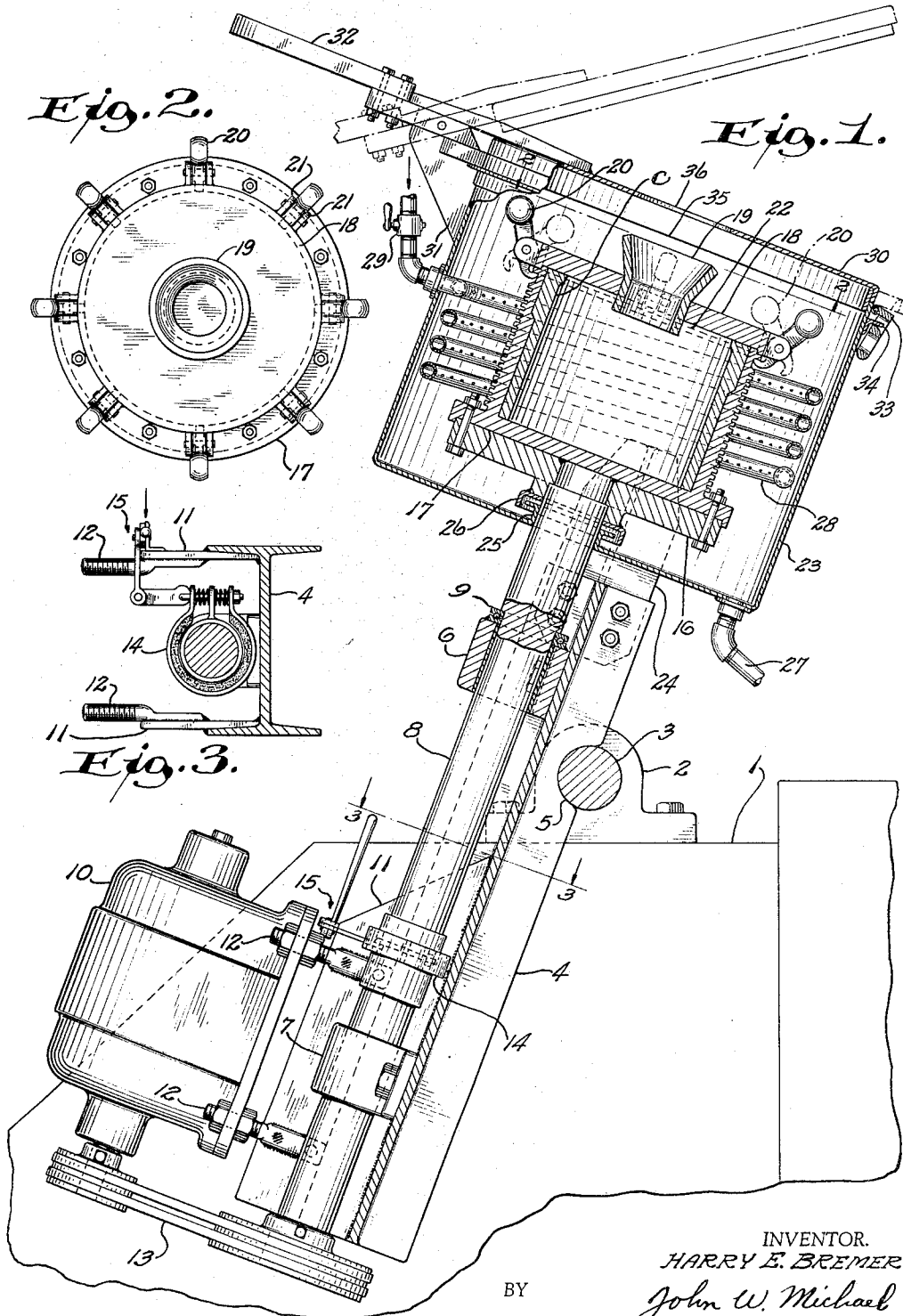
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PROCESS FOR CENTRIFUGAL CASTING

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PROCESS FOR CENTRIFUGAL CASTING

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4 Claims. (Cl. 22—200.5)

This invention relates to an improved process of metal founding and particularly to processes of casting metals by centrifugal force.

One of the objects of the invention is to produce centrifugally forced castings from aluminum alloy which are free from blow holes and other like defects, which have uniform cross-sectional thickness, and which have a smooth interior surface readily adapted for machining.

Another object of the invention is to produce a centrifugally formed casting from aluminum alloy in which slag and other impurities are accumulated in a small area at an edge of the casting where they are readily removable.

The foregoing objects are accomplished by spraying the outside of the revolving mold with water to set the outer surface of the molten aluminum alloy in the mold and almost simultaneously therewith introducing a mass or body of water into the interior of the mold where it will come into direct contact with the molten metal. This bath of water has a unique effect on the inner surface of the casting. It rises upwardly from the bottom of the mold, chilling and setting the interior surface of the casting, but at the same time causing slag and surface impurities to also rise upwardly to the top edge of the casting. As the water evaporates, this slag sets in a small ridge around the upper interior edge of the casting. The remainder of the interior surface is left smooth and free from foreign particles and blow holes. The apparatus for performing this process includes a revolving table upon which the mold is carried. Around this table is a stationary housing provided with spray pipes which direct streams of water against the sides of the mold. The mold is provided with a cover having a central loading funnel through which the molten metal and the subsequent predetermined amount of water may be introduced to the interior of the casting. The housing also has a cover to prevent the splashing of water as the mold revolves. An opening in this cover provides access to the loading funnel. Water and condensate drain from the housing. A so-called centrifugal type of stuffing box prevents water from leaking out between the housing and the shaft.

The novel features, which are considered characteristic of the invention, are set forth with particularity in the appended claims. The invention itself, however, both as to the process of performing it and the organization of the means by which it may be performed, together with additional objects and advantages thereof, will best be understood from the following description of a

specific embodiment when read in connection with the accompanying drawing, in which:

Figure 1 is a sectional view of a centrifugal casting machine embodying the invention with parts shown in full relief for the sake of clarity;

Figure 2 is a fragmentary top plan view taken from line 2—2 of Figure 1; and

Figure 3 is a fragmentary sectional view taken on line 3—3 of Figure 1.

Referring in greater detail to the drawing, the centrifugal casting apparatus is carried between a pair of spaced, concrete base supports 1. Brackets 2 are bolted to the bases 1 and between these brackets extends a round support 3. The main backbone of the apparatus comprises an I beam 4, the flanges of which are notched, as indicated at 5, to receive and engage with the support 3. The I beam is welded or otherwise secured to the shaft 3. On the web of the I beam, near the top, is positioned an upper bearing 6. A lower bearing 7 is also positioned on the web of the I beam near the bottom. These bearings support the drive shaft 8. The latter is provided with a shouldered portion between which, and the upper edge of bearing 6, there is inserted a thrust bearing 9 to carry the weight of the shaft and mold. An electric motor 10 is mounted on the lower end of the I beam 4. To accomplish this mounting, laterally extending plates 11 are welded to the inner flanges of the I beam. To these plates are welded bolts 12 (see Figure 3), so as to be in alignment with the holes in the base of the motor 10. The motor is mounted on these bolts, and is adjustable to and from the shaft 8. A V-belt drive arrangement 13 of customary design connects the motor and the bottom of the drive shaft 8. The tension on the V-belt drive is adjustable by moving the motor toward and from the shaft on the bolts 12.

A brake arrangement 14 having controlling levers and handle designated generally at 15 is installed on the shaft 8 and mounted on the extending plate 11. This brake operates to stop the rotation of the device after the power has been turned off.

The upper end of drive shaft 8 is provided with a reduced portion upon which is fixedly seated the mold table 16. The upper surface of the table is flush with the end of the shaft 8, and it is upon this surface that the molds are positioned and carried. The table is provided with a plurality of holes near its periphery through which bolts are inserted to fasten the mold in place. The mold 17 comprises a cylindrical member having a flat bottom and circular vertical

sides. It is usually made of cast iron. The bottom is provided with an extending flange provided with openings aligned with the openings in the table. The mold may be bolted to the table by bolts passing through these respective aligned openings. It is preferable to reset the bottom of the mold so that the table 16 will fit within the reset and thus more accurately center and hold the mold on the table. It is also preferable to provide radial fins surrounding the vertical sides of the mold for the greater disbursement of heat. The mold shown is designed for forming pipe having a reinforced thickness near one edge. Such a casting, designated by the letter "C," is shown after the metal comprising it has set. A cover 18 is provided for the mold. This cover has a centrally located pouring funnel 19 through which molten metal and other liquids may be introduced into the mold when it is revolving. The cover 18 is clamped to the mold 17 by a series of equally angularly spaced weighted latching dogs 20. These dogs are pivotally carried between ears 21 projecting laterally from the edge of the cover 18. Their upper ends are weighted while their lower ends are provided with hook-like projections. A locking flange 22 extends around the upper periphery of the mold. When the dogs 20 are positioned with the counter-weights in the outward position, the projecting latches engage the under surface of this flange to lock it in place. The cover 18 may be reset upwardly so as to have interlocking engagement with the upper edge of the mold 17. The counter weights on the latching dogs 20 are so related to the pivot that the dogs tend to stay in either the outward or inward position when the cover 18 is not revolving. However, when the mold 17 is revolving, the action of centrifugal force on the counterweights swings the dogs to and holds them in the outer clamped position illustrated in the full lines of Figure 1. To remove the cover 18 after the mold has stopped revolving, the operator merely flips each latch into the position shown by the dotted lines, where they will stay, permitting the cover to be removed and later to be replaced.

In order to properly cast metals such as aluminum alloy, it is desirable to chill and set the outer surface of the molten metal within the mold. To accomplish this, a housing 23 completely surrounding the mold 17 is provided. The housing 23 is of hollow cylindrical shape. It is suspended in stationary position relative to the I beam 4 by two supporting members 24 (only one of which is shown in the illustration). The members 24 are bolted to the outer side of the flanges of the I beam 8. They extend upwardly and outwardly to embrace the housing 23 between them. The housing 23 is welded or otherwise secured to the members 24. The bottom of the housing 23 has a central aperture through which the shaft 8 extends. This aperture is surrounded with a collar and outwardly extending flange 25. The bottom of the table 16 is provided with a collar having a downwardly extending flange 26, which encircles but is slightly spaced from the collar 25. This construction forms a so-called centrifugal stuffing box. The parts are not in surface-to-surface contact. However, the collar 25 prevents water or other cooling liquid from entering between the shaft and the housing while the downwardly extending collar 26 when revolving prevents such liquid from entering over the top of the collar 25. The whole apparatus is positioned at a slight angle to

the vertical, as illustrated in Figure 1. The purpose of this is to facilitate the pouring of metal to the mold and the removal of the casting when sufficiently cooled. A drain pipe 27 is provided in the lower-most part of the bottom of the housing 23 through which excess cooling liquid is drained. A pipe 28, having a series of coils, is placed within the housing 23 with the coils completely surrounding the mold. The lower end of this pipe is plugged, and the upper end extends outwardly through the housing wall and is connected to a source of water supply by a valve 29. A series of apertures is provided on the inner sides of each coil and when the valve 29 is opened, they direct streams of water centrally toward the mold, cooling it simultaneously on substantially its entire outer surface. The top of the housing 23 is open and a pivoted cover 30 is provided therefor. The cover 30 is pivoted between a pair of spaced brackets 31 (only one shown) extending laterally from the side of the housing 23. A counter-weight 32 is provided on an extending arm of the cover to normally raise it to open position. Opposite the pivoted portion of the cover, there is provided a latch 33 which locks over a projection 34 on the housing. When the latch is raised and the housing unlocked, the cover automatically opens, giving full access to the interior of the housing. To make a tight seal, the cover 30 has an interior flange 35 which projects within the upper rim of the housing 23, thus making an interlocking relationship with the cover. The cover 30 has a centrally located opening 36 in alignment with the funnel 19. Thus, even when the cover is closed, molten metal or other liquid can be poured through the opening 36 into the funnel 19 and interior of the mold 17.

In the process of casting aluminum alloy using the apparatus described, the first step is to start the motor and permit it to bring the shaft revolution to approximately 600 R. P. M. This is the speed found satisfactory for a mold of approximately 12 inches in outside diameter. As the outside diameter of the mold is increased, the R. P. M. may be reduced, the purpose being to maintain a peripheral speed which will be sufficient to cause the molten metal to flow and distribute evenly around the inner face of the mold. The molten metal, in the preferred process, comprises an aluminum alloy, of the type generally known and used in the art, heated to a temperature of approximately 1400° Fahrenheit. At this temperature, the metal has sufficient fluidity to flow and evenly distribute before the temperature cools sufficiently for it to set. A predetermined amount of such molten metal is measured out in a ladle. This amount is determined either by volume or by weight. The amount depends upon the outside diameter of the mold, the vertical height, and the cross-sectional thickness desired in the casting. In this instance a ladle containing 39 pounds of the molten alloy is used. When the mold is spinning at the proper speed (after having been pre-heated), the molten metal is poured through the opening 36 into the funnel 19 and thence into the mold. The metal flows upwardly along the sides of the mold until it has attained a substantially even distribution throughout the entire surface of the sides of the mold. Slag and other surface or lighter impurities by reason of the centrifugal action collect on the inner surface of the molten metal as it revolves with the mold. The operator, approximately five seconds after the completion of the pouring, opens the valve 29 and

permits water (relatively cold, being from the city supply) to be sprayed out of the openings in the coil 28. This spray hits the outside of the sides of the mold over substantially its entire area at a substantially simultaneous time. This chills the mold evenly and quickly and causes the outside surface of the molten aluminum alloy in the mold to uniformly set. It should be noted that the latching dogs 20 are positioned on the cover 18 so as not to interfere with the even distribution of the cooling spray on the sides of the mold. Almost simultaneously with the commencement of the outside spray, a quart of water of like temperature as the spray is poured as a mass or body through the opening 36 and funnel 19 into the interior of the mold and within the interior of the molten metal which has now formed itself into the shape illustrated. The effect of this bath of water on the inner surface of the metal, which is still in a molten state, is unique. The surface impurities and slag are caused to ride up the surface from the bottom of the mold and form in a ridge (shown in Figure 1) at the top inner edge of the casting. The remainder of the surface will be set smooth and free from blow holes and surface impurities. The amount of the mass or body of water poured into the mold may vary depending upon the size of the casting desired and the pouring temperature. However, a surplus amount is always used so that there is a short waiting time for such surplus to boil out or evaporate before stopping the apparatus. As soon as the water in the interior of the mold has substantially evaporated, the operator closes the valve 29, cutting off the outside spray. The revolving is then stopped, using the brake lever 15. Merely unfastening the latch 33 permits the top 30 to automatically swing out of the way. Thereupon, the latching dogs 20 are all swung to the inward position, the cover 18 removed, and the casting taken out. Without changing the latching dogs, the cover 18 may then be replaced and the latching dogs swung to outward position. The device is then ready for a recycling of the process.

Although there is shown and described a specific method and process embodying the invention and also specific mechanical embodiments of the invention, many modifications thereof are possible. The invention is not to be restricted except insofar as is necessitated by the prior art and by the spirit of the appended claims.

I claim:

1. The process of centrifugally casting, which consists in pouring aluminum alloy in a molten state into a mold revolving at a speed fast enough

to cause the metal to flow and evenly distribute on the inner surface of the sides of the mold, thereafter spraying the outside of the mold with water to quickly chill and set the outer surface of the alloy, and substantially simultaneously therewith introducing a sufficient mass of water into the mold and into direct contact with the inner surface of said alloy while still molten to form a covering bath of cooling water which moves along the inner surface of the rotating mass of molten metal, causing the same to set quickly without blow holes and causing the impurities to gather and set in a small ridge at one end of the casting thus formed leaving the remainder of the inner surface thereof smooth and free of blow holes.

2. The process of centrifugal casting of aluminum alloy which includes the step of introducing a sufficient mass of water into the interior of the revolving mold and into direct contact with the inner exposed surface of the metal while in a molten state to form a bath of cooling water on the inner surface of the molten metal to cause the metal to set quickly and to cause surface impurities and slag to gather at an edge of the casting which is formed as the molten metal sets leaving the remainder of such surface smooth and free from surface impurities.

3. The process for centrifugally casting aluminum alloy which includes the step of pouring a mass of water into the interior of a revolving mold containing molten aluminum alloy, the amount of water being sufficient to form a covering bath of cooling water on the inner surface of the rotating mass of molten metal to cause the same to set quickly and free from pits and blow holes.

4. The process of centrifugally casting aluminum alloy which consists in pouring aluminum alloy in a molten state into a mold revolving on an axis having a substantial vertical component and at a speed sufficient to cause the metal to flow and evenly distribute itself on the inner surface of the sides of the mold, thereafter applying water to the outside of the mold to quickly chill and set the surface of the alloy casting in contact with the mold surface, and then introducing water directly into the mold in a quantity sufficient to form a cooling bath on the inner surface of the molten metal which rises along the inner surface of the casting to quickly set the same and to cause the impurities to gather in a small ridge at the upper end of the casting thus formed, leaving the remainder of the inner surface thereof smooth and free of blow holes.

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