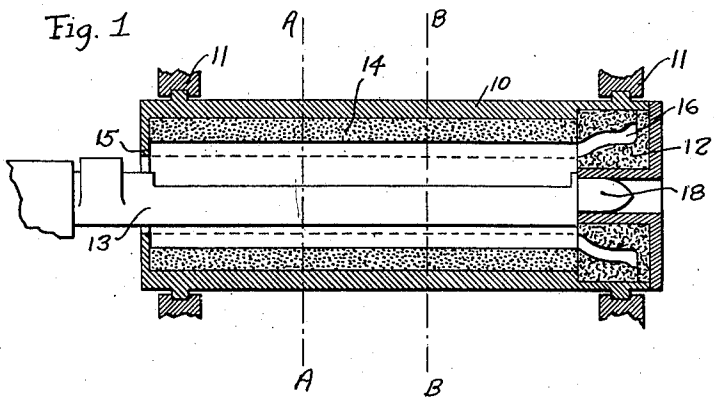
April 20, 1926. 1,581,635

A. M. HENRY ET AL

ROTARY CASTING METHOD AND APPARATUS

Filed July 22, 1924

Fig. 1



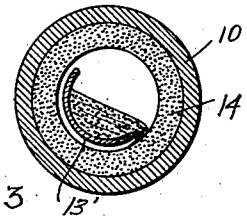


Fig 3

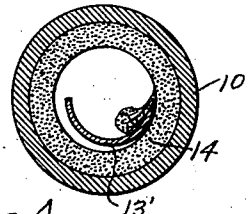
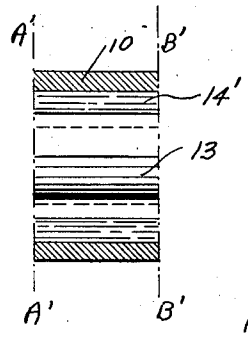


Fig. 4

Fig. 5



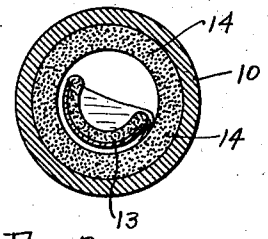


Fig 2

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UNITED STATES PATENT OFFICE.

AUGUSTUS M. HENRY, OF BROOKLYN, NEW YORK, AND CHARLES HORTON, OF RIDGEFIELD PARK, NEW JERSEY, ASSIGNORS TO WILLIAM W. WEITLING, TRUSTEE, OF COLLEGE POINT, NEW YORK.

ROTARY CASTING METHOD AND APPARATUS.

Application filed July 22, 1924. Serial No. 727,419.

To all whom it may concern:

Be it known that we, AUGUSTUS M. HENRY and CHARLES HORTON, both citizens of the United States, the first a resident of the borough of Brooklyn, county of Kings, city and State of New York, and the second a resident of Ridgefield Park, in the county of Bergen and State of New Jersey, have invented a new and Improved Rotary Casting Method and Apparatus, of which the following is a full, clear, and exact description.

This invention relates to rotary casting; and aims to provide an improved method of and apparatus for casting articles, and preferably metallic articles, in a rotating mold.

An object of the invention is to provide a mold which is in effect a permanent mold, in the sense that such mold includes a mold proper of metal or other permanent character, and yet which is not really a permanent mold, in that the part or parts of the mold structure having surfaces which form the molding cavity, or, in other words, the lining of the mold, is impermanent, that is, not held predeterminedly in position, except at such times as the mold is rotating.

Another object is to provide a method of casting which involves utilizing centrifugal force to make the casting, while utilizing centrifugal force to hold a granular, liquid or other free-flowing material, in other words, a non-solid material, in position as a lining for the mold while the mold is rotating.

A further object of the invention is to provide an apparatus for facilitating the carrying out of the method last referred to whereby, as is desirable when said non-solid material is a liquid, the cast article, especially if of annular rather than merely arcuate or other cross section, as a ring, sleeve, tube or pipe, may be withdrawn from the mold parallel to the axis of rotation of the latter, without stopping rotation of the mold,—thus to insure that centrifugal force will maintain the mold lining of the present invention in close contact with and in proper position against the outer or other permanent part of the mold structure.

The invention, as well as objects and advantages thereof other than those already mentioned, will be most clearly understood from the following detailed description of a preferred apparatus as illustrated in the accompanying drawings, in which—

Fig. 1 is a more or less diagrammatic axial section taken through the mold, showing in side elevation, the tilting trough-type of distributor which may be used;

Fig. 2 is a transverse section, through mold and distributor, showing the latter also in section and in the act of feeding molten metal to the mold to make the desired cast article;

Fig. 3 is a view similar to Fig. 2, but showing another type of tilting trough substituted for that shown in Figs. 1 and 2, and to be tilted during rotation of the mold to supply to the outer shell thereof the predetermined quantity of non-solid material to form the lining for the whole or a predetermined part of the mold cavity;

Fig. 4 is a view similar to Figs. 2 and 3, but showing the trough of Fig. 3, arranged with its axis still parallel with the axis of rotation of the mold but slightly eccentric relative to the latter to utilize one of the side edges of such trough as a scraper and remover of surplus material from the inner cylindrical surface of the lining, while the mold is rotating; and

Fig. 5 shows a subdivision of the length of the mold and trough set-up of Fig. 1 corresponding with that shown in the latter figure between lines A—A and B—B, as indicated in Fig. 5 by the presence of the lines A′—A′ and B′—B′,—Fig. 5 illustrating a carrying out of the invention by employing a non-solid lining unlike that shown in Figs. 1 to 4 in that the lining employed according to Fig. 5 is a liquid.

Similar reference characters refer to similar parts throughout the several views of the drawing.

In Figs. 1, 2, 3 and 4, a rotary mold is shown at 10, suitably journalled for rotation as diagrammatically shown at 11 (of course with suitable anti-friction bearings, not shown in such journals). The particular mold delineated is adapted to make cast iron pipe, and is conventionally illustrated and shaped at one end to form the bell-end of the pipe, when the familiar removable bell-core 12 is properly secured in place as indi-

cated (means not shown) for the casting of such a pipe.

The proper charge of molten metal may be poured into the mold from the familiar tilting-trough type of distributor shown at 13; which is preferably axially removable from the mold, by suitable means not deemed necessary to be illustrated in view of the state of development of the art in this particular, at the end of each casting operation, to facilitate removal of the article cast. This trough 13 is shown in cross section in Fig. 2, in the act of being tilted for rotation to spill its charge into the mold during rotation of the latter to make the desired casting.

According to Figs. 1, 2, 3 and 4, the lining characteristic of the present invention is an annular mass 14 of loose or free-flowing material, as fine sea-beach sand, or indeed any granular material which is free-flowing and of fine grain and so constituted as to have little if any chemical reaction with the constituents of the molten metal being cast. In the case of a sleeve or tube-like article the cross section of which at any point along its length is bounded by two concentric circles the diameter of neither of which circles varies at any such cross section, the metal shell 10 constituting the permanent part of the mold may merely have inwardly directed circular flanges at both ends as indicated in Fig. 1 at 15, and the annular mass 14 may extend all the way along the mold from one such flange to the similar flange (not shown) at the opposite end of the mold. As the new casting machine is actually shown in Fig. 1, however, such annular mass 14 only extends along that portion of the length of the mold which is to shape the part of the casting which is of the cross-sectional characteristic last hereinabove defined; in other words, the illustrated mold being for the making of a belled pipe, the annular mass 14 is coextensive in length with all portions of the pipe except the bell thereof. The bell-end of the pipe is formed in the annular cavity indicated at 16 and opposite such cavity the shell 10 is equipped with a permanent lining formed of compressed carbon, preferably carbon of the non-graphitic form and containing very little graphite.

It is the contemplation of the invention, carried out according to the discussion already made, to use the same granular or similar material constituting the mass 14 for a great plurality of pipe, and until the granular material, if sand, is well "burned". It will be understood that if the mold is stopped in its rotation each time a cast pipe is removed, the annular shape of the mass 14 will be broken up and all the lining material will drop to the bottom of the mold. But on restarting rotation of the mold, annular distribution of the mass 14 will be reestablished almost immediately, and the entire mold structure is ready for the making of another pipe. Or the mold may be continued rotating during the entire run of a plurality of casting operations, at at least a sufficient speed between casting operations, in order to maintain the annular character of the mass 14. Then it will be desirable and probably most economical in the long run, to shave off and clear away the inner cylindrical surface of the annular lining 14 to a very slight depth and to a depth just sufficient to remove the "burned" surface material. Such scraping away of a small fraction of the mass 14 may be done at the end of the casting of each pipe, but probably it will suffice to scrape away the superficial material at every fourth of fifth or even tenth casting operation. Of course additional increments of fresh granular material are added to the main mass 14, to bring the internal diameter of the mold lining up to that predetermined, each time the mass 14 is scraped as above described. The new material is supplied by employment of the trough 13′ of Fig. 3, the same trough used for establishing the annular lining 14 initially. Very precise predetermination of the charge of granular material to be given the trough 13′ in any case, need not absolutely be depended on, since it is obvious, in even the elementary structure shown in Fig. 1, that, assuming the bell-core removed, the only thing to be settled in addition is that there is at least enough granular material in the trough 13′ to make the lining 14 of the predetermined thickness; since when the lining has been compacted in place by centrifugal force it will proceed to distribute itself longitudinally of the mold between flange 15 and the carbon lining 17 until the inner surface thereof forms an absolutely perfect cylinder concentric with the axis of rotation of the mold, the surplus granular material, if any, being whirled out by centrifugal force over the bell-forming superfices of the carbon lining 17. In order to perform the scraping operation above described relative to the annular lining 14, the same trough 13′ shown in Fig. 3 may be employed, as indicated in Fig. 4. In such Fig. 4, the trough 13′ is scraping away the lining 14 as shown (the mold structure being assumed to be rotating in a clockwise direction), as the result of shifting the trough 13′ to the left of the axis of rotation of the mold to the required amount. To facilitate such shifting of the trough 13′, to constitute the latter as a scraper as above, suitable mounting and moving means (not shown) may be brought into engagement with portions of the trough 13′ protruding beyond opposite ends of the mold. Of course when the trough 13′ is used as

above described, the bell-core is removed from the mold structure; and since, as explained, the right-hand end of the trough 13′, as such trough would be viewed if in place in Fig. 1, is to be engaged by means not illustrated, the trough 13′ differs in construction from the trough 13, in that the former is not provided with the pivot pin 18 carried by the latter.

Instead of a granular impermanent lining for the permanent mold shell, the invention also contemplates the use of a liquid impermanent lining, such as molten lead, copper, Monel metal or the like; it only having to be specified that such liquid, preferably a metal, must satisfy the four following conditions, to wit, (*a*) it must have a fusion point lower than that of the metal to be cast, (*b*) it must have a specific gravity greater than that of the metal to be cast, (*c*) it must have a temperature of vaporization lower than the fusion point of the metal to be cast, and (*d*) it must be of such a character as not chemically to combine at all or at least not deleteriously with the charge of metal being formed into the casting by cooling in and during rotation of the mold. During the cooling of the casting, heat units therefrom are given up to the liquid lining, thus keeping the latter liquid; so that the liquid impermanent lining of the present invention is held in position by the utilization of heat as well as centrifugal force.

Such a carrying out of the invention is illustrated in Fig. 5, which, between the lines A′—A′ and B′—B′ represents the corresponding longitudinal subdivision of the showing between lines A—A and B—B. Here the mold 10 and trough 13 are present as in Fig. 1, but the lining 14′ is now not granular, but a liquid as described in the paragraph immediately preceding. If the metal to be cast is ferrous, for instance, copper or Monel metal is recommended for the lining 14′. If the metal to be cast is aluminum or copper, for instance, lead is recommended.

Thus, in perhaps its broadest aspect, the invention presents, in the art of rotary casting, the method of casting which involves utilizing centrifugal force to form a mold or a subdivision of a mold lining bounded by a surface forming at least part of the mold cavity, such subdivision being impermanent except during rotation of the mold; which subdivision, as the invention is at present understood, is either granular, as fine sand, iron rust, pulverized carbon, graphite, etc., etc., or a liquid, as just described.

When a granular material is used according to the invention for the entire or a major part of the mold lining, the cast article (and this is particularly important when such article is a cast iron pipe) will not be chilled, obviously. In cases where part of the mold lining, as at the bell-end of a pipe mold, is gas carbon as defined in United States patent to Henry No. 1,501,338, or in cases where a part of the lining is nichrome or some other metal, as a ring of such metal to form an annular subdivision of the mold cavity between the parts of such cavity formed by the carbon pieces and by the non-solid material characteristic of the present invention, it may be desirable to steam-jacket the mold, to maintain the temperature thereof as desired, opposite said carbon and metal, according to the method disclosed in our copending application Serial No. 727,417 filed herewith or the copending application of Horton Serial No. 727,418 filed herewith.

Reverting to Fig. 5, illustrating the use according to the present invention of a mold lining of liquid rather than granular material, it is finally explained that certain first-glance defects are not, on close analysis, practical impedimenta. Thus, it may be asked, when you stop your mold to remove the casting, what happens to the liquid lining? The answer is, as hereinabove indicated, that it is recommended the mold be rotated between as well as during the successive casting operations of a day's run. Whereupon it may be asked, how do you get your pipe out? And our answer is, that very simple arrangements may be devised (as they have already been devised by us) by practically any good engineer or even mechanic; such arrangements including means for moving away the bell-core, means for thereupon advancing an expanding grapple into the bell of the whirling casting (such grapple being a terminal enlargement on a shaft journalled for rotation about an axis concentric with the axis of rotation of the mold and casting), means for engaging the grapple and the bell to cause the grapple-shaft and the casting to rotate as one unit, means for moving the shaft axially away from the mold to slidably withdraw the cast pipe, and one or more auxiliary supporting and guiding means, as roller carrying cradles on horizontal axes arranged laterally of and below the grapple-shaft, these cradles to be swung up successively as the rotating casting is withdrawn more and more from the rotating mold, to support the casting at different points along its exposed length.

We claim:

1. In the art of rotary casting, the method of casting metals which involves utilizing centrifugal force to form a mold lining bounded by a surface forming at least part of the molding cavity, such subdivision being impermanent except during rotation of the mold.

2. In the art of rotary casting, the method of casting metals which involves utilizing centrifugal force to form a mold lining bounded by a surface forming at least part of the molding cavity, such subdivision being impermanent except during rotation of the mold, such subdivision when thus formed being made up of a non-solid material.

3. In the art of rotary casting, the method of casting metals which involves utilizing centrifugal force to form a mold lining bounded by a surface forming at least part of the molding cavity, such subdivision being impermanent except during rotation of the mold, such subdivision when thus formed being made up of a free-flowing material.

4. In the art of rotary casting, the method of casting metals which involves utilizing centrifugal force to form a mold lining bounded by a surface forming at least part of the molding cavity, such subdivision being impermanent except during rotation of the mold, such subdivision when thus formed being made up of a liquid material.

5. In the art of rotary casting, the method of casting metals which involves utilizing centrifugal force to form a mold lining bounded by a surface forming at least part of the molding cavity, such subdivision being impermanent except during rotation of the mold, such subdivision when thus formed being made up of a liquid metallic material.

6. In the art of rotary casting, utilizing centrifugal force to hold a non-solid material in position as an impermanent lining for the mold.

7. In the art of rotary casting, utilizing centrifugal force and heat to hold a non-solid material in position as an impermanent lining for the mold.

8. In a rotary casting machine, the combination of a mold shell, and a lining for such shell formed of loose free-flowing material.

9. In a rotary casting machine, the combination of a mold shell, and a lining for such shell formed of a material adapted at a certain temperature to be distributed within the mold by centrifugal force during rotation of the latter.

10. In a rotary casting machine, the combination of a mold shell, and a lining for such shell formed of a material adapted at a certain temperature to be liquefied for distribution within the mold by centrifugal force during rotation of the latter.

11. A machine as defined in claim 10, such material having a fusion point lower than that of the metal to be cast and a specific gravity greater than that of said metal.

12. A machine as defined in claim 10, such material having a fusion point lower than that of the metal to be cast, a specific gravity greater than that of said metal and a temperature of vaporization lower than the fusion point of said metal.

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