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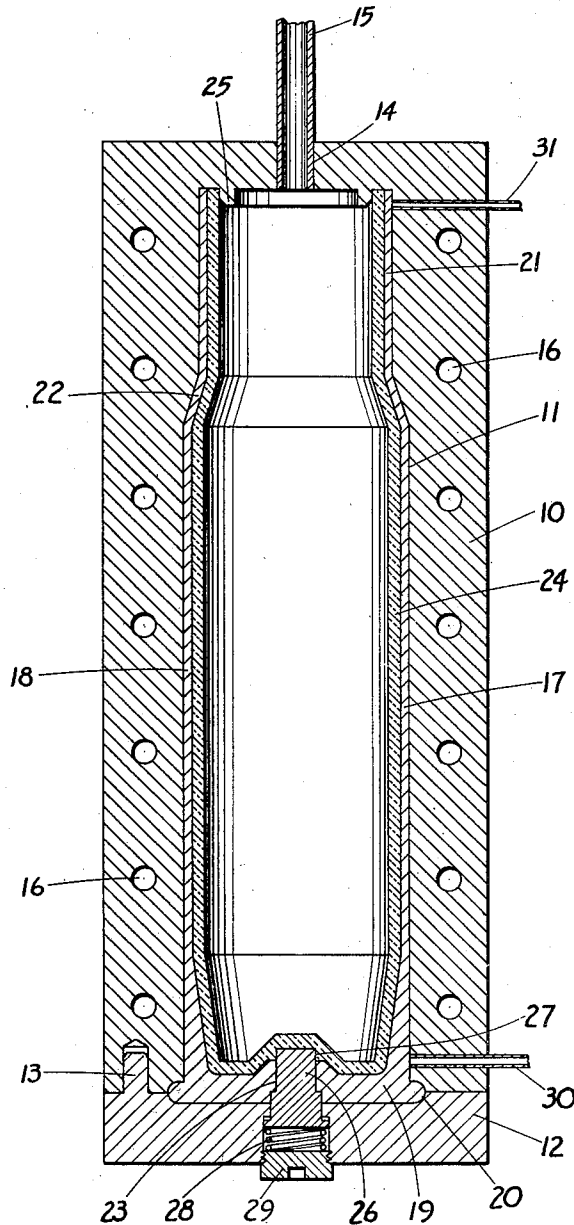
J. S. BRAZIL

2,304,879

CASTING METHOD

Filed May 15, 1940

3 Sheets-Sheet 1



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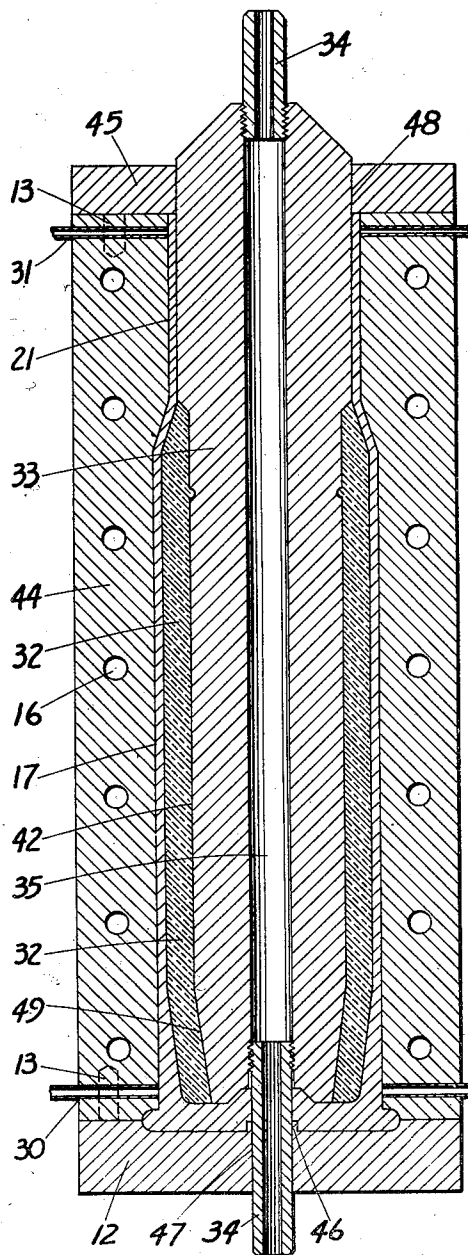
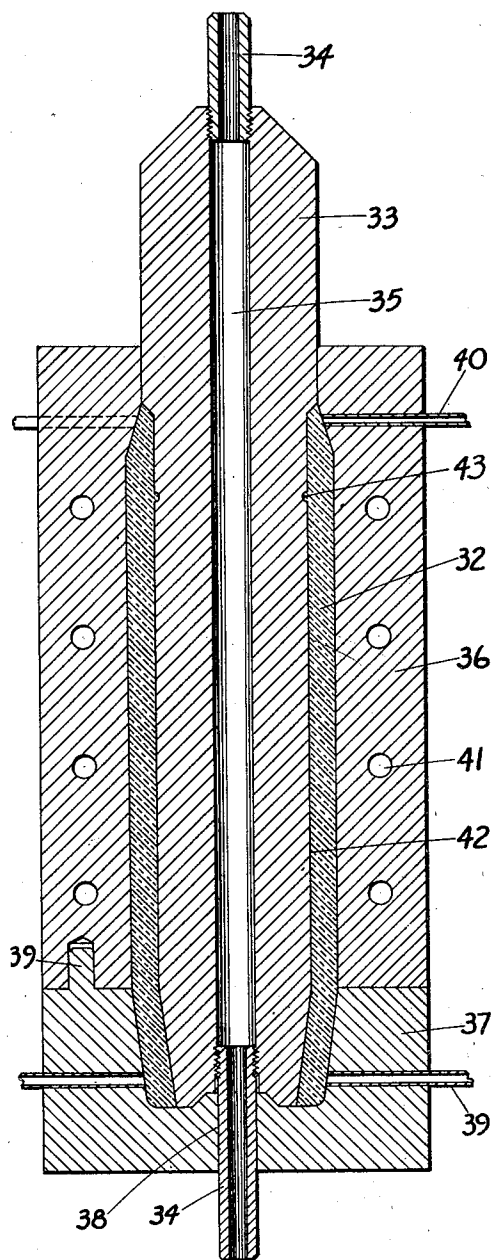
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CASTING METHOD

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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

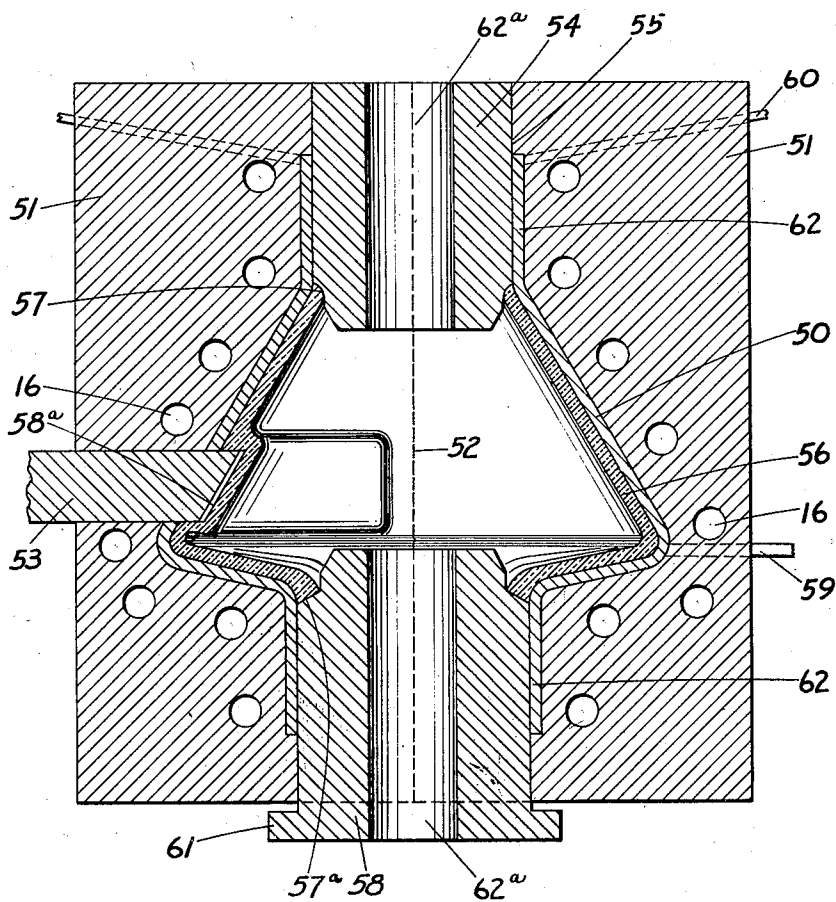


FIG. 4

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UNITED STATES PATENT OFFICE

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CASTING METHOD

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3 Claims. (Cl. 22—190)

This invention relates to a method and apparatus for making castings. The invention is calculated to fulfill the needs of several different types of castings and is capable of a wide range of modification.

Certain types of castings must have smooth inside surfaces. Such castings have normally been machined on their inner surfaces to obtain the required degree of smoothness. By the use of my invention the necessity for machining the inner surfaces of a casting is substantially if not wholly eliminated.

Other types of castings are of such shape that the inner core of the casting may not be removed whole after the cast is made. This occurs where there is a part of the core which in lateral dimension exceeds the opening in the casting through which the core would normally be removed. It is of course an old practice to provide sand cores for castings of this nature but such cores are often faulty and involve considerable labor and care. In addition, it is practically impossible to obtain a smooth finish on that surface of the casting which contacts the sand without machining.

Certain types of castings present the joint problem of requiring a smooth inside finish and are of such shape that the core cannot be removed whole. Certain other types of castings have these characteristics and due to their nature must have uniform wall thicknesses and must otherwise be held within extremely close dimensional limits.

This invention is primarily applicable to castings having one or more of the above mentioned characteristics and is also advantageous in connection with other types of castings, no matter how simple or complicated they may be. An object of my invention is to provide a casting core which may be easily removed after the casting has cooled; which provides the casting with a surface which either needs no machining or an extremely small amount of machining; and which is of material benefit in obtaining castings of uniform cross-section and closely held dimensional accuracy. A further object of my invention is the provision of a core apparatus and the method of making and using it which lend themselves to progressive automatic operations characteristic of mass production.

Other objects of this invention will become apparent from the reading of the following specifications together with the drawings, in which:

Figure 1 is a longitudinal section through a casting apparatus utilizing the invention.

Figure 2 is a longitudinal section illustrating a

method of making a different type of core than that illustrated in Figure 1.

Figure 3 is a longitudinal section through a casting apparatus utilizing the core made in accordance with Figure 2.

Figure 4 is a longitudinal section through a casting apparatus illustrating a further modification of the invention.

Referring to Figure 1, 10 is a mold having a round cavity 11 extending through the greater portion of its length. One end of the mold 10 is open and is adapted to be closed, during the casting operation, by a mold cap 12 which is held in accurate relationship with the mold 10 by means of a series of dowels 13 and by the usual clamps (not shown). The opposite end of the mold 10 is provided with a hold 14 in which a vent pipe 15 may be fitted to allow heated air to escape from the interior of the mold. The mold, the outer surface of which may be square or of any other desired shape, is normally provided with a series of passages 16 for the circulation of water or any other cooling medium.

In Figure 1 there is illustrated, as one of the many types of castings which may be made, an artillery shell casing designated generally by the numeral 17. Normally, this type of shell casing is characterized by a main body portion 18, a base or end 19 of greater thickness having a flange 20 and a neck portion 21 of reduced diameter, joined to the main body portion 18 by a short tapered section 22. The base 19 is apertured centrally as at 23 to receive the usual cap.

In this form of the invention, the core for the casting 17 is preferably made of glass in the form of a bottle, the outer contour of which is the exact shape of the inner surface of the shell casting to be made. The core 24 is uniformly round in cross-section and is centered in the closed end of the mold 10 by fitting closely around an annular shoulder 25. After the core 24 has been inserted in the mold the cap 12 is applied and clamped in position. The centering pin 26, associated with the cap 12 is pressed into firm engagement with a recess 27 in the end of the core 24 by means of a spring 28 confined by a threaded cap 29.

The molten metal inlet 30, one or more of which may be provided, is preferably located near one end of the mold 10 and is advantageously located near that portion of the casting which is to have the greatest wall thickness. One or more vents 31 are provided at the opposite end of the mold.

The core 24 is preferably made of glass having a melting point of 2400° F. The metals to be cast have melting points substantially below the melt-

ing point of the core and a few of these will be mentioned: brass and/or copper—1950° F. approximately; lead—700° F.; zinc casting alloys—approximately 1000° F., and aluminum having a melting point of approximately 1200° F. It will be understood that other metals in this range may also be cast by this method. Metals having melting points higher than 2400° F. may also be cast by using a glass core of a still higher melting point.

In operation, the mold 10 may or may not be preheated. The glass core 24 is preferably preheated to near its annealing temperature to relieve internal strains and eliminate the possibility of the glass breaking due to sudden temperature change when the casting is made. The preheated glass core 24 is placed in the mold 10 and the cap 12 is clamped in place. The molten metal is then poured or injected through the inlets or sprues 30. At the proper time after the casting cavity has been filled the cap 12 is removed and the casting withdrawn from the mold. Under certain conditions the differential rate of contraction between the casting and the glass core will cause the core to break. Under other conditions it will simply be necessary to tap the glass core with a small tool such as a hammer to break it into pieces small enough to be removed through the neck 21 of the casting.

Glass cores of the type shown present a relatively simple manufacturing problem to a glass manufacturer and may be shipped in large numbers to the munitions plant. In addition, it is conceivable that the broken fragments of the core may be returned to the glass manufacturer and re-used in the making of new cores.

Referring to Figures 2 and 3 there is shown an alternative or modified method of casting a shell casing of the identical type shown in Figure 1. In Figure 2, there is illustrated a mold for making the glass core. In this instance a combined metal and glass core is to be used. It will be noted that the glass core 32 is adapted to form that portion of the shell casing which is of larger diameter than the neck portion 21.

The metal core 33 is cylindrical in shape and has a small plug 34 threadedly engaged with each of its ends. The core 33 may have a central bore 35. The plugs 34 facilitate handling of the cores in successive automatic steps employing conveyor means. As the first step in a possible automatic line-up a conveyor could be used to bring the metal core 33 to a glass mold station, one of which is illustrated in Figure 2. The core is placed in a mold 36 and the cap 37, having a bore 38 closely fitting one of the plugs 34 and dowels 39, is fitted and clamped to the mold 36. A glass core 32 in the form of a sleeve is then cast in the cavity between the core and the mold by pouring or injecting molten glass through the inlets 39 in cap 37. Vent pipes 40 are located near the opposite end of the mold 36 and passages 41 are provided for a cooling fluid such as water.

After the glass core 32 has hardened sufficiently the cap 37 is removed and the combined metal and glass core 42 may then be removed. The glass core may be keyed to the metal core by providing a series of small depressions 43 into which the molten glass will flow.

The combined core may then be automatically moved to another station illustrated in Figure 3 in which the core 42 will be positioned in a mold 44. Mold 44 is generally similar to the mold shown in Figure 1 and the parts thereof have been identified by similar reference numerals

wherever possible. In addition to cap 12 another cap 45 may be employed to enclose the opposite end of the mold. Cap 12 in Figure 3 is provided with a projection 46 and a bore 47 for one of the plugs 34. The opposite end of the core is positioned closely as at 48.

In the formation of the casting the core 42 will be preheated to approximately the annealing temperature of the glass portion 32 to relieve strains therein and will then be positioned in the mold 44. Caps 12 and 45 are then clamped in place and the molten metal poured or injected through inlets 30. At the desirable time after the casting has been formed, caps 12 and 45 are removed and the metal core 33 may then be removed by tapping it at the end nearest its tapered portion 49. The casting and the glass core 32 may be removed through the end adjacent cap 12. The glass core may then be broken out by tapping as pointed out before.

Alternatively the combined core 42 and the casing 17 may be removed from the mold 44 as a unit and the parts separated at a later stage. The keys 43 will offer little resistance to the removal of the metal core 33 from the glass core 32.

Referring to Figure 4 there is illustrated the apparatus for casting a different type of article such as a steering wheel hub. Motor cars of recent years have utilized gear shift levers movable about a pivot within the steering wheel hub. In Figure 4 such a steering wheel hub is shown at 50. A two-part mold 51, adapted to be split on line 52 has an interior shape suitable for the casting to be made. A movable plunger or insert 53 is provided. In practice, a cylindrical metal core 54 may be positioned closely in the mold 51 as at 55. A preformed and preheated glass core 56 is then positioned on the annular shoulder 57 of core 54 and core 58 is then placed with its shoulder 57a centering the glass core. The sequential positioning of these core members may be reversed or otherwise modified. The mold halves 51 are then closed and the insert 53 is projected into a suitable recess 58a formed in the glass core 56. Recess 58a and insert 53 are designed to provide an arcuate slot in the wall of the hub casting 50 for the reception of the above mentioned gear shift lever.

With the core and mold parts in position molten metal is poured or injected through one or more inlets 59 in the mold 51. Vent holes 60 are provided. After the casting is completed the insert 53 is withdrawn and core 58 may be pulled out by utilizing the flange 61. Cores 54 and 58 are centrally bored as at 62a to facilitate the escape of heated air from the interior of the core or to admit heated air to maintain the preheated temperature of the glass core 56 prior to casting.

After core 58 has been removed core 54 may be tapped out of the mold by means of a tool inserted from the opposite end of the mold. The mold halves 51 are then opened along line 52 and the casting 50 and the glass core 56 may then be removed as a unit. As mentioned previously, under certain conditions the glass core will be cracked and broken by the differential rate of contraction of the casting and the glass. Under certain other conditions the glass core may be broken out by means of a small hammer. It will be noted that the straight cylindrical portions 62 of the casting 50 are formed between the metal cores 54 and 58 and the adjoining portions of mold 51. That portion of the casting which is larger in diameter than either of the portions 62 is formed by the glass core 56.

It will be seen that the casting of metals in the method described and by means of the apparatus shown and described will permit substantial departures from standard casting practices. The surfaces of the glass core which define the inside wall of the casting are extremely smooth and this feature results not only in a smooth inside finish for the casting but facilitates the flow of the molten metal during the casting operation. It is essential in casting practice to make the casting shot as rapidly as possible in order to obtain uniformity. It will further be seen that cores of glass or other frangible materials lend themselves readily to various combinations with metal or other cores. The cores are frangible to the extent that under certain conditions the contraction of the casting will in itself break the core into pieces sufficiently small to be removed through almost any size opening in the casting. Under certain other conditions it is a simple matter to break the glass core out. It is to be understood that frangible materials other than glass may be used without departing from the scope of this invention and that the word "glass" has been used merely to illustrate the invention rather than limit it to the use of one specific material. Other types of plastics and materials are con-

templated. In addition, this apparatus and method can be used for the casting of thermoplastic and thermo-setting materials.

I claim:

1. The method of casting which includes casting a glass portion on a metal core in a mold, inserting said core into a second mold, making the cast, removing the metal portion of the core from the casting and breaking the glass core out of the casting.
2. The method of casting which includes forming a glass portion on a metal core having a plug, moving said core to a mold by means engageable with said plug to support the core during the movement thereof, inserting said core into said mold, positioning said core within the mold by means engageable with said plug, making the cast and removing the core from the casting.
3. The method of casting which includes forming a hollow glass core with openings, inserting the core into a mold having openings, positioning said core in the mold by means closing the openings in said mold and engageable with the openings in said core, making the cast and removing the core from the casting.

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