April 28, 1931. E. G. FAHLMAN 1,803,300

PERMANENT MOLD

Filed July 12, 1929 4 Sheets-Sheet 1

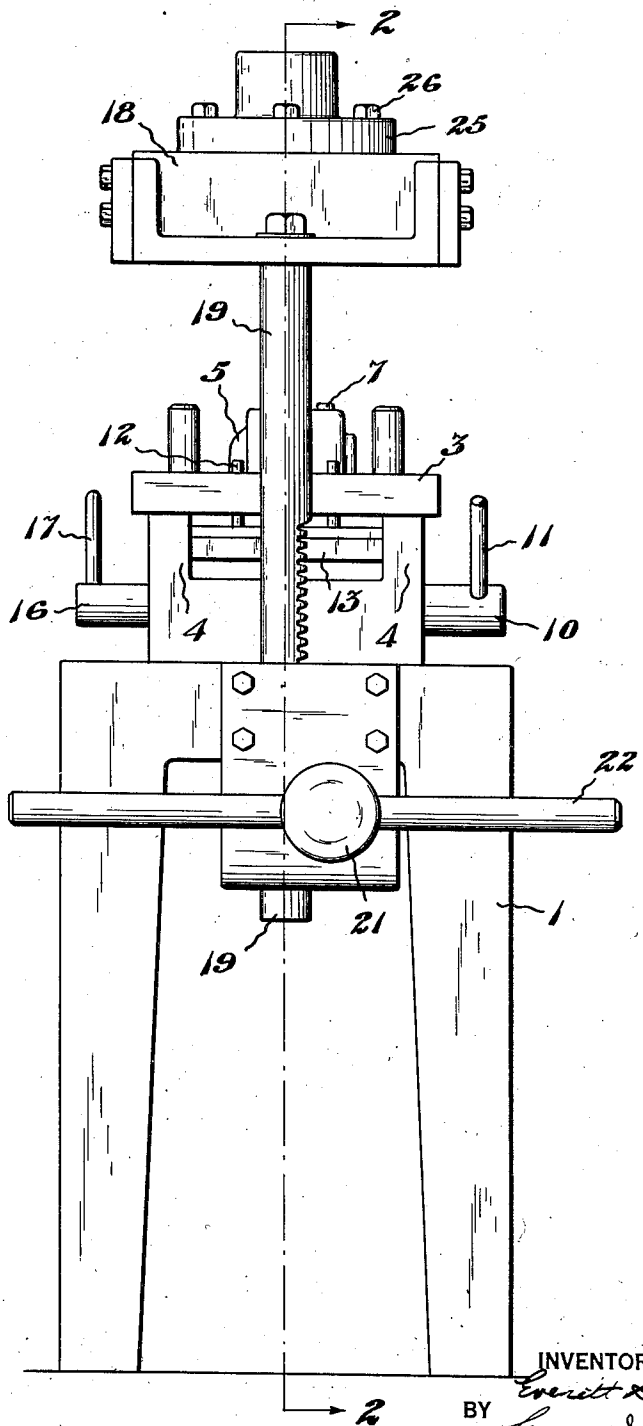


Fig. 1.

INVENTOR
Everett G. Fahlman
BY
Evans & Mecoy
ATTORNEYS

April 28, 1931. E. G. FAHLMAN 1,803,300

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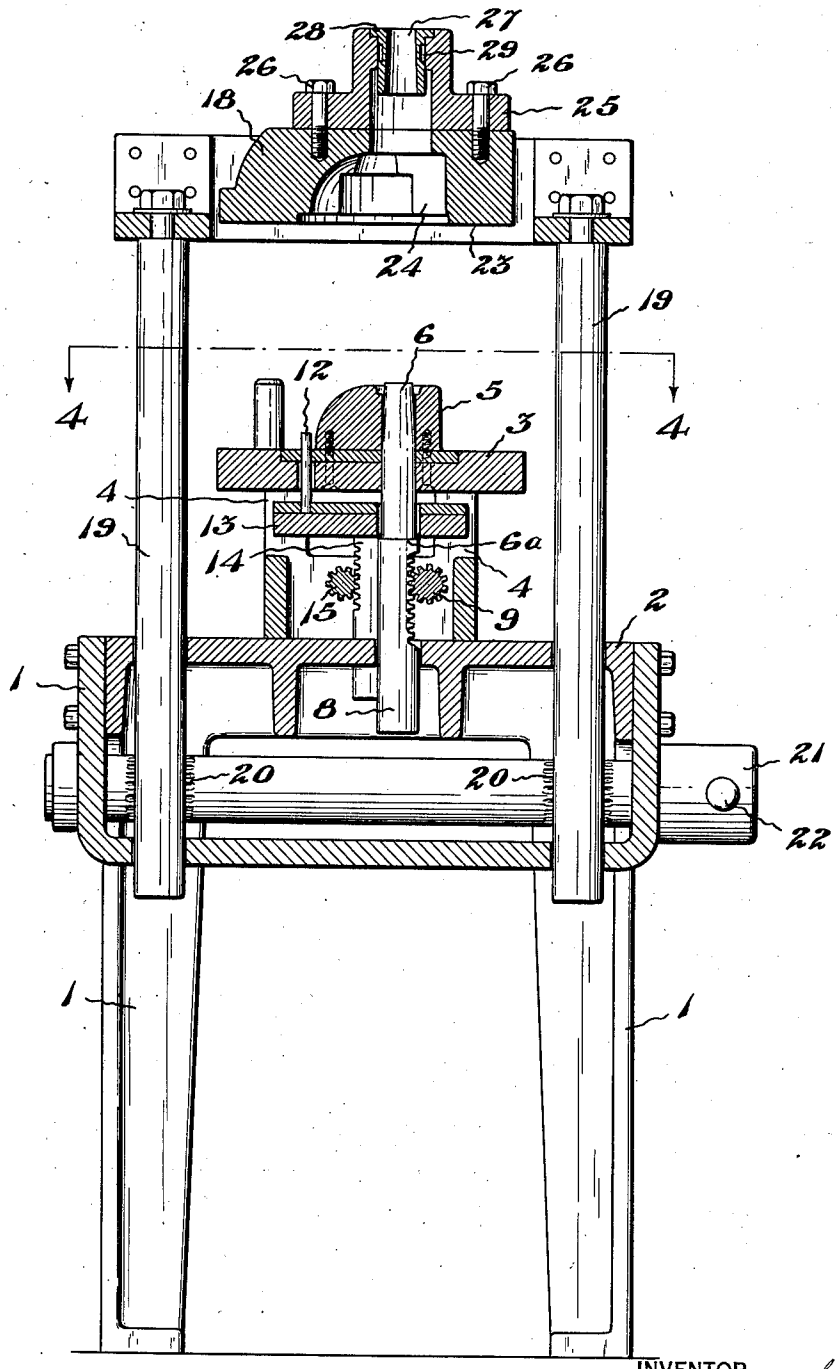


Fig. 2.

INVENTOR
Everett G. Fahlman
BY
Evans & Mclay
ATTORNEYS

April 28, 1931. E. G. FAHLMAN 1,803,300

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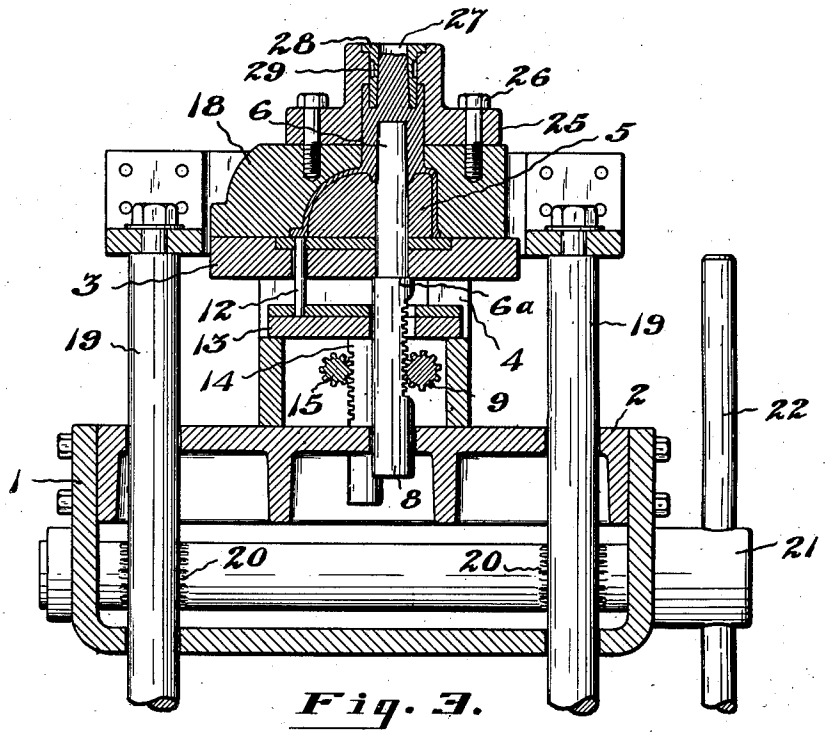


Fig. 3.

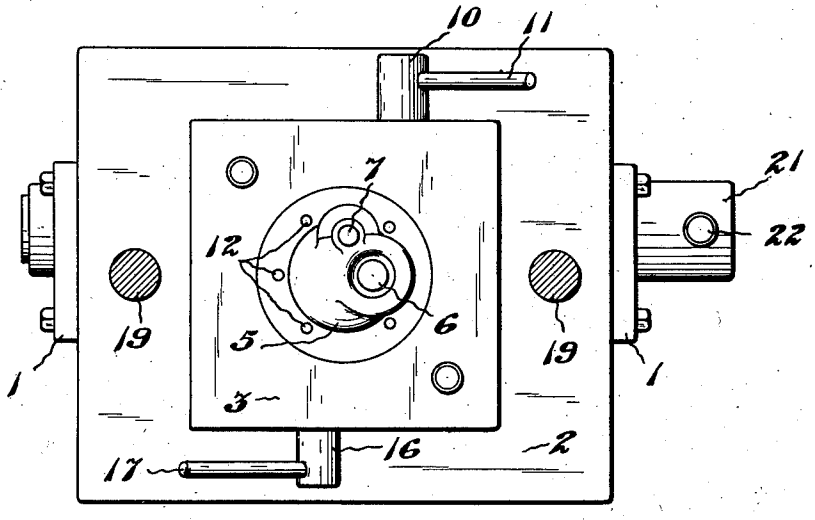


Fig. 4.

INVENTOR
Everett G. Fahlman
BY
Evans & McCoy
ATTORNEYS

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Filed July 12, 1929 4 Sheets-Sheet 4

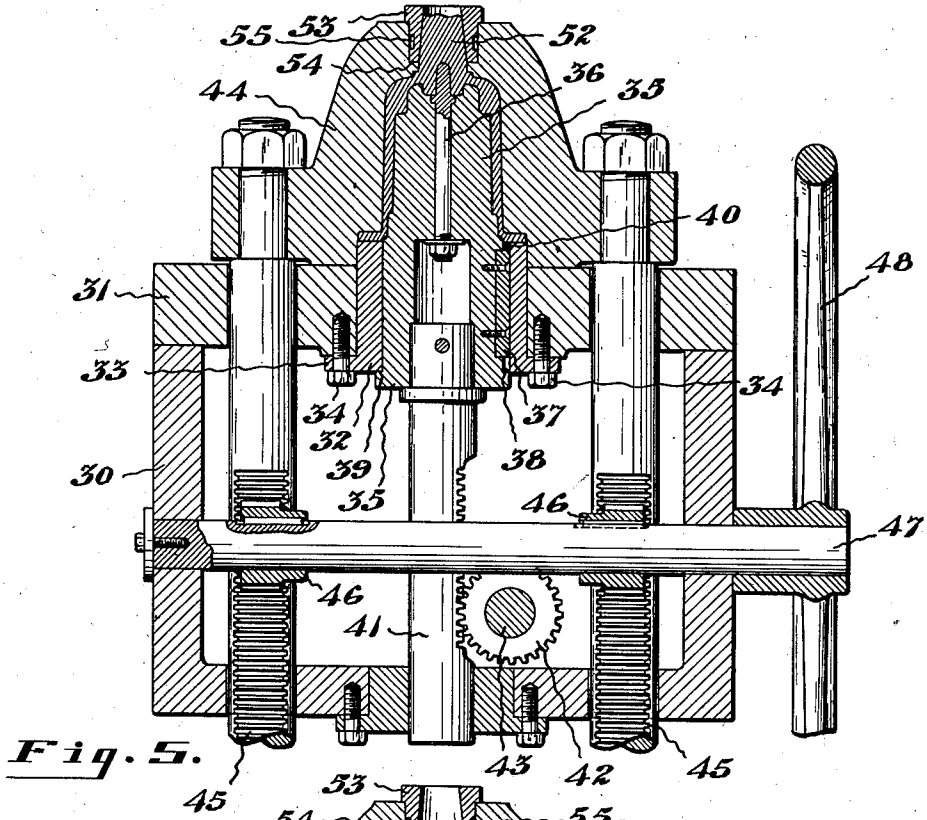


Fig. 5.

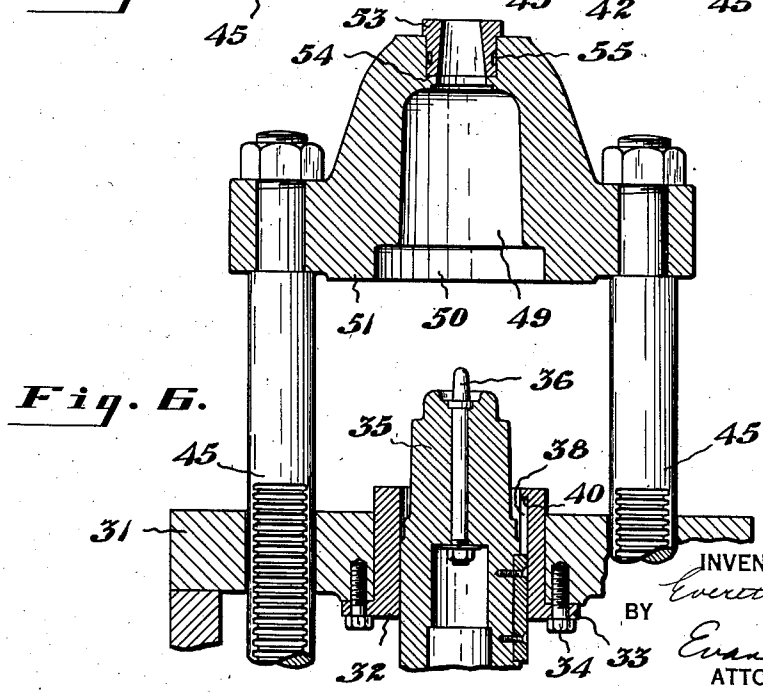


Fig. 6.

INVENTOR
Everett E. Fahlman
BY
Evans & McCoy
ATTORNEYS

Patented Apr. 28, 1931 1,803,300

UNITED STATES PATENT OFFICE

EVERETT G. FAHLMAN, OF CLEVELAND, OHIO, ASSIGNOR TO THE PERMOLD COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

PERMANENT MOLD

Application filed July 12, 1929. Serial No. 377,633.

This invention relates to permanent metal molds for casting metal articles and more particularly to molds for casting metals having a relatively high crystallization shrinkage and a relatively low fusing point such as aluminum and its alloys.

The present invention has for an important object to provide a mold for casting hollow articles which will produce articles which have more nearly perfect uniformity with respect to external and internal dimensions and having external surfaces which are smooth throughout the extent thereof.

A further object is to provide a mold in which the entire casting cavity or substantially the entire casting cavity is formed in one of the metal mold members so that the exterior surface of the casting is formed against a smooth continuous surface.

A further object is to provide a mold member in which the entire casting cavity or substantially the entire casting cavity is formed which has a gate for admission of molten metal to the casting cavity which is so designed as to permit the mold member to be moved axially with respect to a casting formed therein to free the mold member from the casting and sprue.

A further object is to provide a mold of the character above referred to which is provided with a core member mounted for movement into and out of the mold cavity of the one piece mold member and provided with actuating means whereby it may be moved outwardly to free a casting from the core.

With the above and other objects in view, the invention may be said to comprise the mold as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification in which:

Figure 1 is a side elevation of a mold embodying the invention showing the main mold member in elevated position.

Fig. 2 is a central vertical section through the mold taken on the line indicated at 2—2 in Fig. 1.

Fig. 3 is a central vertical section through the mold with mold members in operative position and with a casting in the mold.

Fig. 4 is a section taken on the line indicated at 4—4 in Fig. 2.

Fig. 5 is a central vertical section through a mold of slightly modified construction showing a casting in the mold.

Fig. 6 is a sectional view of the mold shown in Fig. 5 with the mold members separated.

The permanent mold of the present invention is a horizontally divided mold in which the upper section is the main mold member and has the casting cavity formed therein and in which the lower section forms the base of the mold and carries the core upon which the interior of the casting is formed. The gate for admitting molten metal is formed in the upper mold section and opens into the upper end of the casting cavity. The upper section of the mold is mounted for vertical movement so that it can be separated from the base to free the casting from the mold, the gate in the upper section being so designed that the upper section will readily move upwardly way from the sprue as well as from the body of the casting.

The mold illustrated in Figs. 1 to 4 of the drawing is designed for casting an end member of a gear housing, the upper section of the mold having a cavity conforming to the entire exterior surface of the casting and the bottom section or base member carrying core members each conforming to the interior surface of the casting.

As shown in Figs. 1 to 4 of the drawing, a mold is mounted upon a supporting frame 1 which is provided with a horizontal bed 2 upon which is mounted a mold base 3, spaced above the bed 2 and supported on standards 4 extending upwardly from the bed. The mold base 3 has fixed thereto a main core member 5 and centrally of the main core member 5, there is slidably mounted an upwardly projecting core pin 6. Laterally of the main core pin 6, there is mounted a stationary core pin 7 secured to the main core member 5.

The slidable core pin 6 is guided for vertical movement through the main core member 5 and is carried by the upper end of a vertical rack 8 which extends downwardly through and is guided in the bed 2. The rack 8 is engaged by a pinion 9 fixed to a transverse shaft 10 and this shaft is provided outside the frame with a hindle 11 by means of which it may be turned to adjust the core pin 6 upwardly or downwardly, there being a shoulder 6a at the base of the pin 6 which engages with the bottom of the base member 3, to limit the upward movement of the pin. For freeing the casting from the core member 5, a series of vertical thrust pins 12 may be provided around the bottom of the main core member 5, these pins being mounted upon a head 13 attached to the upper end of a vertically disposed rack 14 which is engaged by a pinion 15 on a transverse shaft 16, which has a handle 17 at one side of the frame by means of which the head 13 may be moved vertically to move the thrust pins 12 from a position flush with the top of the mold base upwardly to lift the casting and free it from the core member.

The upper main mold member 18 is secured upon the upper ends of vertically disposed rack bars 19 which are slidably mounted in the bed 2 adjacent opposite ends thereof and, beneath the bed 2, the rack bars 19 are engaged by pinions 20 fixed to a transverse shaft 21 which projects beyond one end of the frame and has attached thereto handle bars 22 by means of which the shaft may be turned to raise and lower the rack bars 19 simultaneously to move the main mold member 18 upwardly away from the base member or downwardly into engagement with the base member.

The mold member 18 has a bottom face 23 which engages with the mold base 3 and is provided with a cavity 24 which conforms to the exterior surface of a casting formed in the mold. The mold cavity 24 is formed entirely within the one mold section so that a smooth continuous surface is provided for forming the exterior surface of the casting throughout the periphery of the casting. As shown in Figs. 1 to 4, the top portion of the upper mold section may be in the form of a cap 25 which is rigidly secured to the body portion of the mold member by means of bolts 26, the cap and the body of the mold having accurately machined contacting faces so that the surface of the cavity is smooth and continuous.

The upper end of the casting cavity extends into the cap 25 and the cap is provided with a gate 27 opening centrally into the upper end of the cavity. The gate 27 has a gradual taper upwardly from the lower end thereof which opens into the casting cavity so that an upwardly tapering sprue is formed therein from which the gate portion of the mold may be separated by upward movement of the mold member. If desired, the gate 27 may be formed in a metal insert 28 which fits in a bore formed in the cap 25 and which has an external groove 29 which forms an air chamber which serves to retard the conduction of heat from the sprue and prevent freezing in the gate which would interfere with free flow of metal to all parts of the mold cavity.

In the operation of the mold, the main mold member 18 is lowered onto the mold base 3, the slidable core pin 6 is moved to its uppermost position and the head 13 is moved downwardly to withdraw thrust pins 12 from the casting cavity and to position them with their upper ends flush with the surface of the base member. With the core members assembled as above described, the lower end of the casting cavity is closed by the base member 3, the main core member 5 and core pins 6 and 7 conforming to the interior of the casting and to the apertures thereof, while the cavity 24 of the main mold member 18 conforms to the entire exterior surface of the casting to be formed.

Mold metal is poured into the cavity through the gate 27 which is of relatively large diameter and insulated by the annular air chamber 29 so that the metal may flow to all parts of the mold cavity before the sprue portion begins to congeal. As soon as the casting has solidified, the core pins 6 and 7 are retracted by actuating the rack 8 and the main mold member is lifted off the casting by actuating the racks 19, whereupon the casting may be readily forced off of the main core member 5 by actuating the rack 15 carrying head 13 and thrust pins 12.

In Figs. 5 and 6 of the drawings, there is illustrated a mold for casting an article of somewhat different form than the casting formed by the mold illustrated in Figs. 1 to 4. In this modification, the mold is supported upon the frame 30 having a horizontally disposed bed 31 which is provided with a central aperture in which is mounted a bushing 32 which projects slightly above the surface of the bed and which has an outwardly projecting flange 33 at its lower end which is secured to the bottom of the bed by means of bolts 34.

The bushing 32 forms a guide for a vertically movable core member 35 which has a sliding fit in the bushing and which may be provided with a centrally disposed pin 36 which projects from the upper end thereof. The core member 35 is held against turning movement in the bushing 32 by means of a key 37 attached thereto which slides in a keyway 38 formed in the bushing. The upward movement of the core member is limited by a shoulder 39 at the lower end of the core member which engages with the lower end of the bushing and by a shoulder 40 at the up-

per end of the keyway 38 which terminates short of the upper end of the bushing so that the core member has a close fit in the bushing throughout the periphery thereof at the upper end of the bushing.

The core member 35 is fixed to the upper end of a vertically disposed rack 41 which is guided for vertical movement in the frame and which is engaged by a pinion 42 fixed to a transverse shaft 43 which may be turned manually to raise or lower the core member.

The main mold member 44 is fixed to the upper ends of vertically disposed racks 45 which are guided for vertical movement in the frame 30 and which are engaged by pinions 46 fixed to a transverse shaft 47, one end of which projects to the outside of the frame and has a handwheel 48 attached thereto by means of which the shaft may be turned to actuate the racks 45 and raise or lower the main mold member. The main mold member 44 has a cavity 49 formed therein which is coaxial with the core member 35 and which conforms to the exterior surface of the casting throughout the extent thereof.

The cavity 49 has an enlarged lower end 50 which fits closely over the projecting upper end portion of the bushing 32 and the bottom face of the mold member has an annular bearing portion 51 which engages the top surface of the bed 31.

The enlarged portion 50 of the casting cavity is of a height somewhat greater than the projecting portion of the bushing 32 to provide a space between the upper edge of the bushing and the shoulder at the upper end of the enlarged portion 50 of the cavity in which the base flange of the casting is formed. The core member 35 fits closely within the upper end portion of the bushing 32 so that the bushing serves to close the lower end of the casting cavity. At the upper end of the main mold member 44, there is formed an upwardly tapering gate 52 which is coaxial with the casting cavity in which there is formed an upwardly tapering sprue which will permit the mold member to be moved vertically out of contact with the casting formed in the mold. The gate, if desired, may be formed in a metal insert 53 which fits in a counterbore in the top of the mold member 44 with its lower end resting upon the shoulder 54 at the lower end of the counterbore. The insert 53 may be provided with a peripheral groove forming an annular air space 55 between the insert and the body of the mold member, which serves to lessen the heat conductivity between the insert and the body of the mold member so that the chilling of the sprue is less rapid than it otherwise would be, thereby insuring an unimpeded flow of molten metal through the gate into the casting cavity until the cavity is completely filled.

In both modifications above described, the entire exterior surface of the casting is formed against the smooth uninterrupted surface of a cavity formed in a single mold member thereby eliminating any seam or fin such as formed between separable mold sections.

Furthermore absolute uniformity with respect to the exterior dimensions of the casting is insured since all castings are formed against the same continuous surface.

In addition the construction and operation of the mold is simplified, the mold comprising fewer parts and less complicated actuating mechanisms.

Furthermore it is to be understood that the particular form of apparatus shown and described and the particular procedure set forth, are presented for purposes of explanation and illustration and that various modifications of said apparatus and procedure can be made without departing from my invention as defined in the appended claims.

What I claim is:

1. In a permanent mold adapted for casting substantially cup-shaped articles from aluminum alloys and the like, in combination, a support, a single mold section defining the outer surface of a cup-shaped casting cavity opening downwardly, said mold section being further recessed to define a sprue cavity tapering upwardly from said casting cavity, guided means for moving said mold section upwardly out of, and downwardly into, molding position on said support, a permanent core cooperating with said support and defining the interior of said casting cavity, and means for causing relative vertical movement between said core and a casting whereby freezing of a casting on the core may be prevented.

2. In a permanent mold adapted for casting substantially cup-shaped articles from aluminum alloys and the like, in combination, a support, a single mold section defining the outer surface of a cup-shaped casting cavity opening downwardly, said mold section being further recessed to define a sprue cavity tapering upwardly from the apex of said casting cavity, the portion of the mold section defining said sprue cavity being provided with an air space to reduce the rate of freezing of the sprue metal, means for moving said mold section upwardly out of and downwardly into predetermined molding position on said support, a permanent core carried by said support and defining the interior of said casting cavity, and means cooperable with the periphery of the casting and actuable upwardly to raise said casting off the core to prevent freezing of the casting onto said core.

3. In a permanent mold adapted for casting substantially cup-shaped articles from aluminum alloys and the like, in combination, a support, a single mold section defin-

ing the outer surface of a cup-shaped casting cavity opening downwardly, said mold section being further recessed to define a sprue cavity tapering upwardly from the apex of said casting cavity, a raised mold centering portion on said support for accurately positioning the mold section in predetermined molding position, means for moving said mold section upwardly out of and downwardly into predetermined molding position in cooperative relation with said mold centering portion on said support, a permanent core arranged to be moved upwardly into molding position within said casting cavity and to be withdrawn downwardly therefrom, means for limiting the extent of upward movement of said core into said casting cavity, said mold centering portion being arranged to cooperate with and support the lower edges of the casting during the withdrawal of the core.

In testimony whereof I affix my signature.

EVERETT G. FAHLMAN.