July 8, 1930. E. G. FAHLMAN 1,770,368

MOLD

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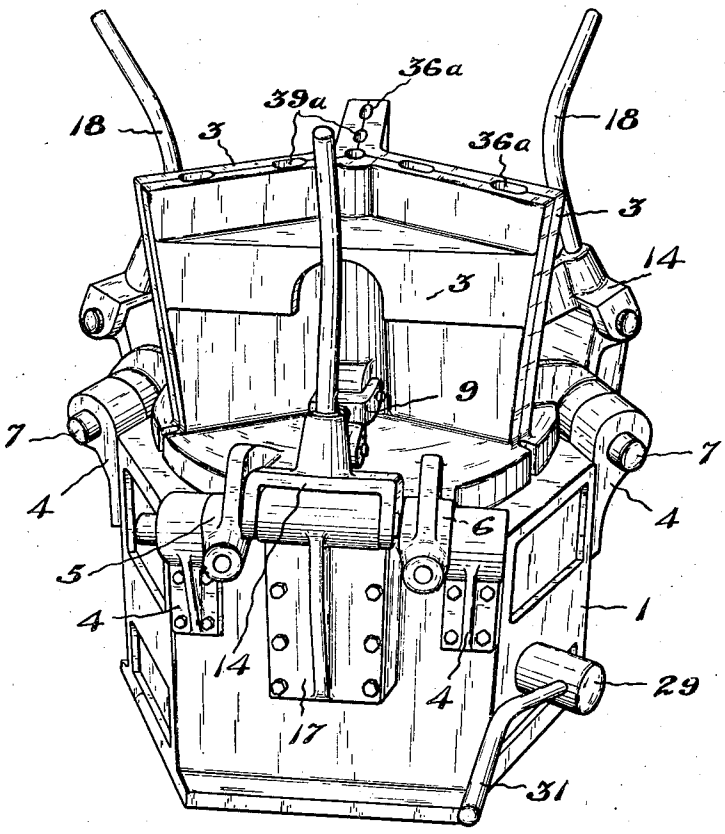


Fig. 1.

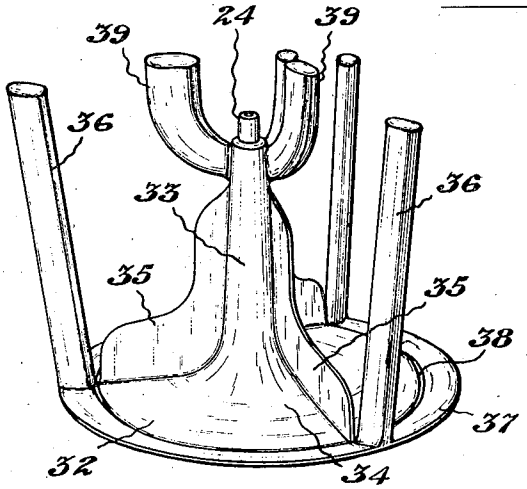


Fig. 2.

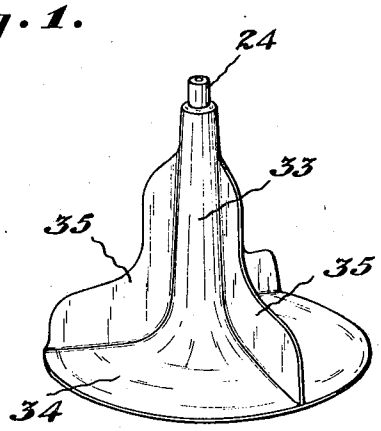


Fig. 3.

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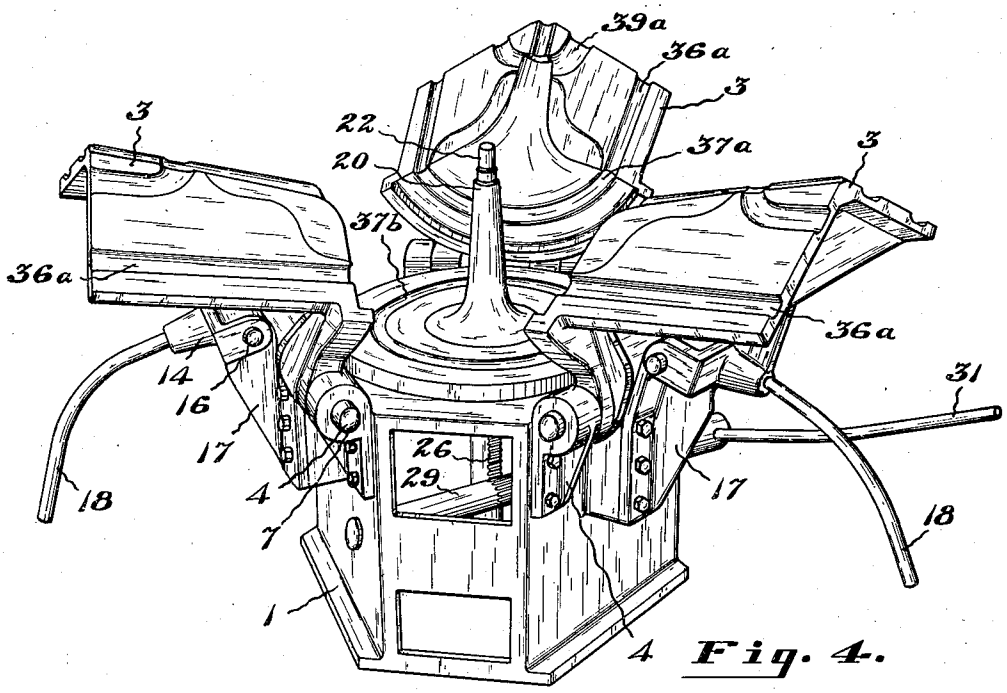


Fig. 4.

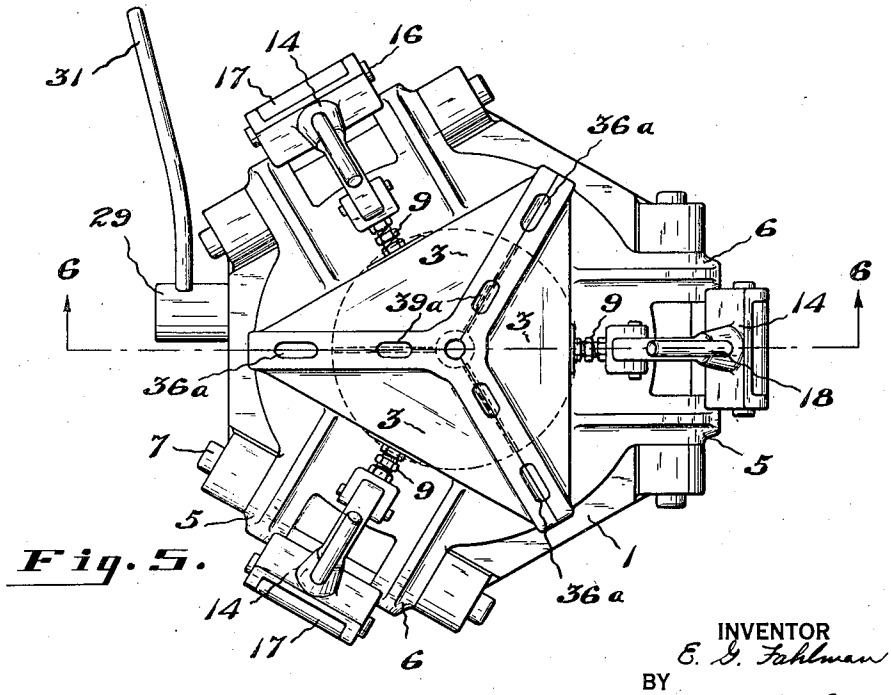


Fig. 5.

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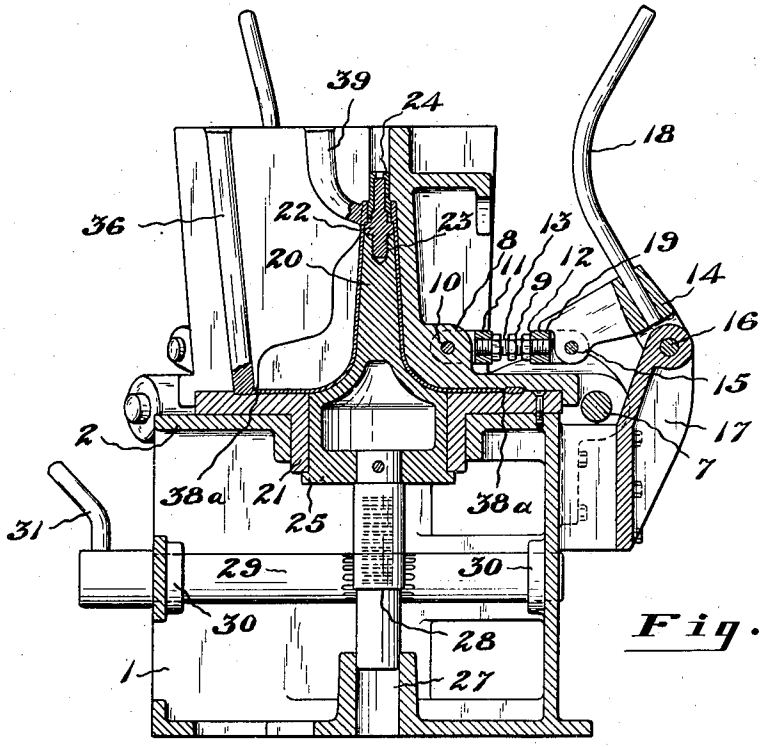


Fig. 6.

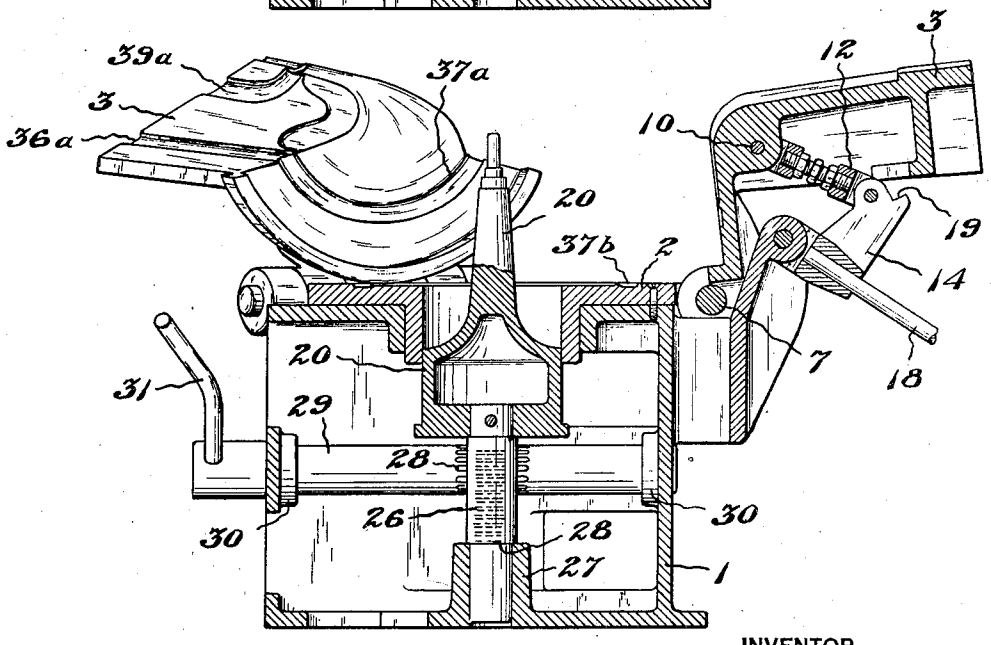


Fig. 7.

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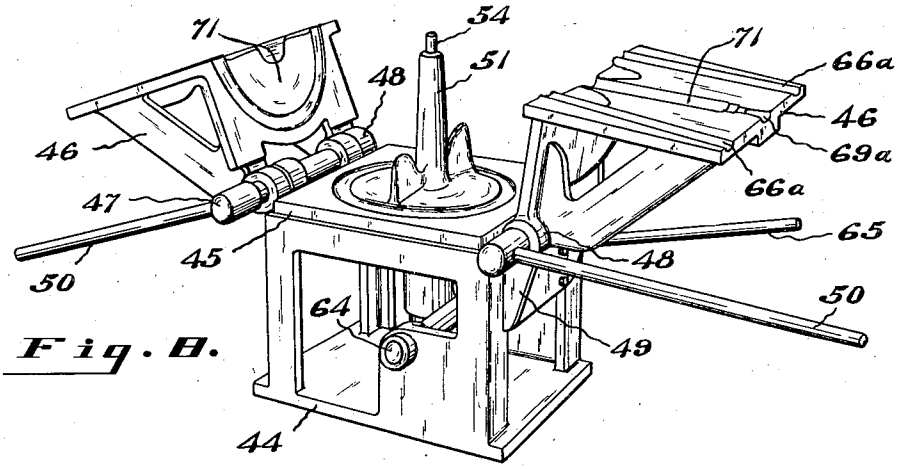


Fig. 8.

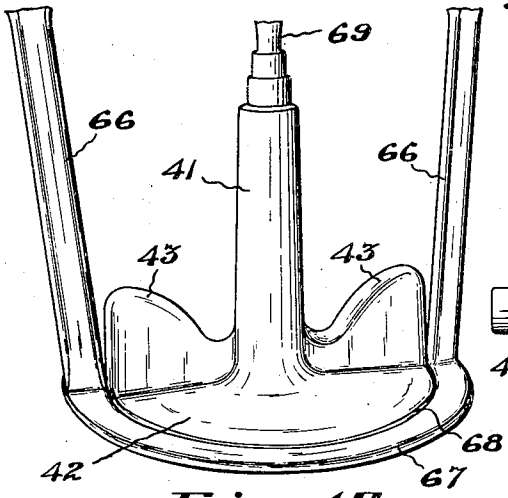


Fig. 10.

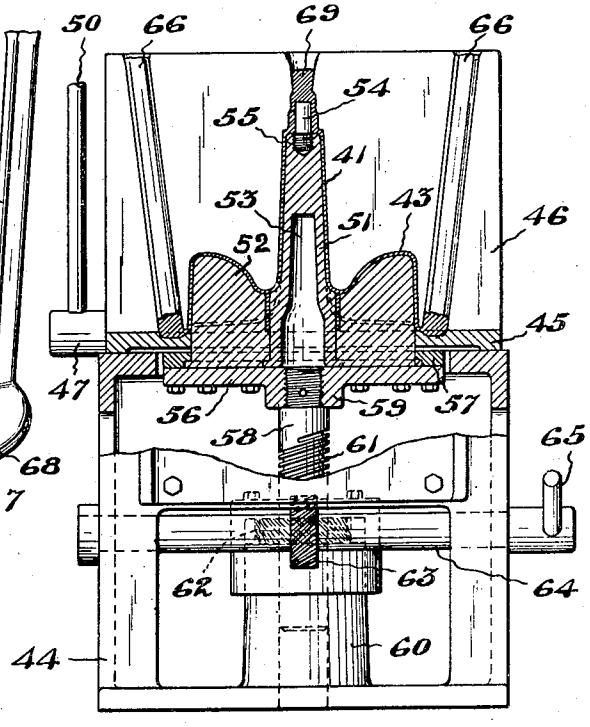


Fig. 9.

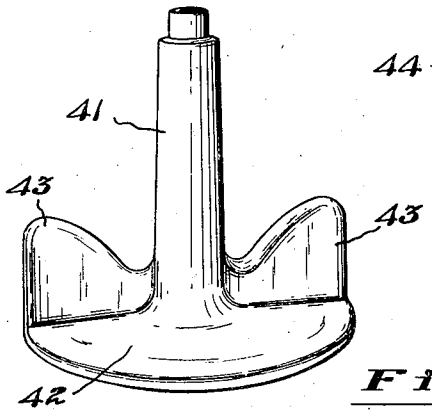


Fig. 11.

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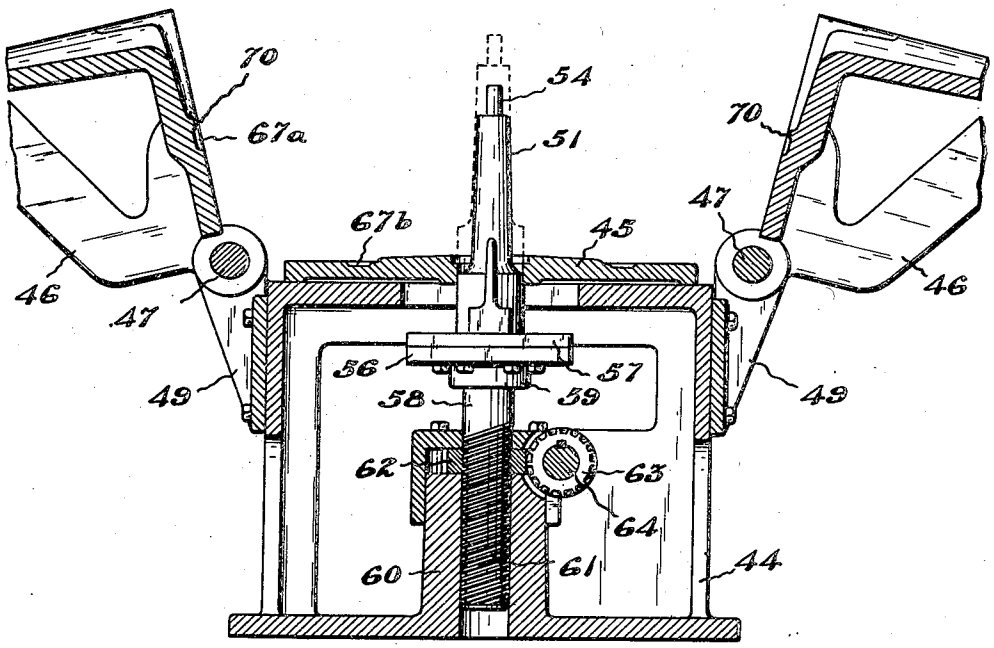


Fig. 12.

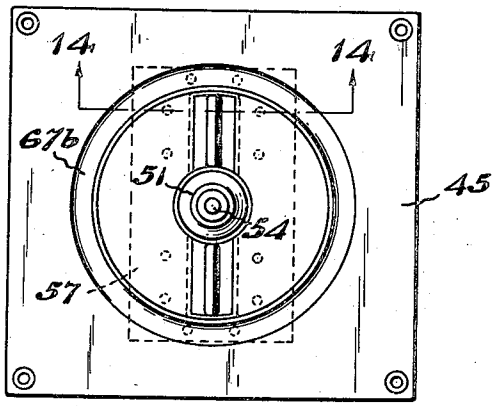


Fig. 13.

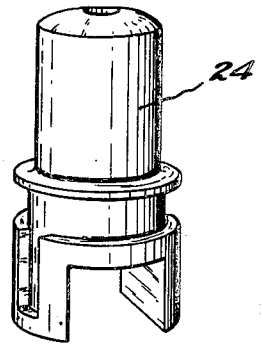


Fig. 15.

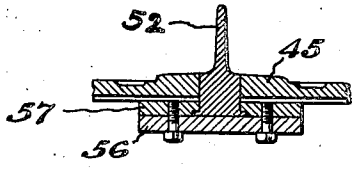


Fig. 14.

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UNITED STATES PATENT OFFICE

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MOLD

Application filed April 18, 1929. Serial No. 356,036.

This invention relates to permanent molds, and more particularly to molds for producing washing machine dollies and other articles of similar form.

An object of this invention is to provide a permanent mold with advantageous characteristics for the casting of aluminum and other light alloys.

Other objects are to provide a mold which is particularly advantageous for casting articles having relatively extensive thin portions and to provide advantageous means for introducing molten metal into the cavity of a mold for such articles.

Another object is to provide a permanent mold for the casting of washing machine dollies and the like which is particularly adapted for the casting of metal of relatively low melting point and relatively high crystallization shrinkage.

Other objects of the invention will be apparent to those skilled in the art from the disclosures herein made and from the appended drawings wherein

Figure 1 is a perspective view of one form of mold contemplated by my invention;

Fig. 2 is a perspective view of the casting formed in the mold shown in Fig. 1 before removal of the sprues and risers;

Fig. 3 is a perspective view showing the casting illustrated in Fig. 2 after removal of sprues and risers;

Fig. 4 is a perspective view of the mold shown in Fig. 1, the mold sections being separated to show the interior of the mold;

Fig. 5 is a top plan view of the mold shown in Fig. 1;

Fig. 6 is a vertical sectional view taken on line 6—6 in Fig. 5;

Fig. 7 is a sectional view similar to Fig. 6 showing the mold sections in open position;

Fig. 8 is a perspective view of a modified form of mold contemplated by my invention, the mold sections being open;

Fig. 9 is a vertical sectional view through the center of the mold shown in Fig. 8;

Fig. 10 is a perspective view of a casting formed in the mold illustrated in Fig. 8 before removal of the sprues and riser;

Fig. 11 is a perspective view of the casting shown in Fig. 10 after removal of the sprues and riser;

Fig. 12 is a central vertical section through the mold taken in a plane at right angles to that of the section shown in Fig. 9;

Fig. 13 is a top plan view of the base portion of the mold with the hinged sections omitted;

Fig. 14 is a section taken on the line indicated at 14—14 in Fig. 13; and

Fig. 15 is a perspective view of a metallic insert which may be cast into the upper end of the stem of the casting.

By this invention, I have provided a mold particularly adapted for the casting of articles having thin portions of relatively large area and having hollow portions as in the case of a washing machine dolly. The mold, as herein illustrated, is arranged for the casting of a dolly in a substantially upright position. A core is arranged to move upwardly into molding position to define the hollow interior of the body of the casting. A plurality of separable mold sections are provided which co-operate to define the exterior surfaces of the casting. The mold is so constructed that molten casting metal may be introduced into the mold cavity substantially throughout the lower periphery of the bell or flange portion of the casting through a plurality of sprue cavities including a ring sprue cavity.

The mold illustrated in Figs. 1 to 7, inclusive, comprises a base 1 upon which is disposed a plate 2, the top surface of which is shaped to conform to the under side of the base portion of the casting to be formed in the mold. Three movable mold sections 3 are arranged to co-operate with each other

and with the plate 2 to define the exterior surfaces of the casting. Each mold section 3 is pivotally mounted on the base 1 by means of bearing brackets 4 secured to the base, interfitting knuckles 5 and 6 on the respective mold sections and associated brackets, and pins 7 extending through the knuckles 5 and 6 of each mold section and associated bracket.

The mold sections 3 are arranged to be moved to or outwardly from molding position by suitable toggle mechanisms. Thus, there is secured to a boss 8 on each mold section 3, the inner end of an extensible link 9 which is pivotally connected to the boss 8 by a pivot pin 10. The extensible link 9 has inner and outer end portions 11 and 12 adjustably connected by means of a screw 13, the outer end 12 being in turn pivotally secured to a toggle arm 14 by means of a pivot 15. Each toggle arm 14 is pivotally secured by a pin 16 to a bearing bracket 17 secured to the base 1. Each toggle mechanism is operated by a lever 18 extending into a socket in the toggle arm 14 and each toggle arm is provided at its inner end with a shoulder 19 projecting past the pivot 15 and engageable with the link end 12 to which the arm is pivoted with the toggle pivot slightly past dead center position to prevent outward movement of the mold section from its molding position. The toggle mechanism above described provides a simple and advantageous means for moving the mold sections and also for locking the mold sections in molding position.

A core 20 centrally disposed with respect to the mold sections is mounted for vertical movement in a bushing 21 at the center of the base. The core 20 is shaped to conform to the interior surface of the casting and is preferably made hollow to reduce the weight of the core and to limit the chilling effect of the core upon the casting. At its upper end, the core 20 is provided with a tip member 22 secured thereto by a threaded end 23. The tip member 22 may serve to define the upper interior portion of the casting or may serve to support a cap or metallic insert to be cast into the stem of the dolly or other casting to be formed in the mold. Upward movement of the core into the mold cavity is limited by a shoulder 25 on the core which is arranged to engage the lower surface of the bushing 21.

The core 20 may be moved upwardly into and downwardly out of molding position by means of a rack and pinion. As herein shown, a rack 26 is secured at its upper end to the bottom of the core 20 and is slidable at its lower end in a bushing 27 formed in the base. A shoulder 28 on the rack 26 is arranged to abut the upper end of the bushing 27 to limit the downward movement of the core and the rack is moved vertically up or down by means of a pinion 28 meshing therewith and carried by a shaft 29 journaled in bearings 30 in the base and having attached thereto a lever 31 by which it may be turned.

Referring particularly to Figs. 2 and 3, it will be noted that the washing machine dolly casting 32 formed in the mold comprises a central hollow stem portion 33, a lower bell or flange portion 34 and radial wings 35. The casting 32 is of relatively thin section throughout its extent. The formation of perfect castings in a permanent mold from aluminum alloys having relatively low melting point and relatively high crystallization shrinkage presents difficult casting problems. For example, with such a casting as is shown, it is exceedingly difficult to introduce the casting metal uniformly throughout the entire mold cavity to form a casting free from voids and cold shuts.

I have devised an advantageous means of introducing molten casting metal into the casting cavity which is illustrated in Fig. 2 wherein are shown three circumferentially spaced sprues 36 which extend from the top of the mold to the bottom of the casting, a ring sprue 37 which extends around the periphery of the bell or flange portion of the casting, and which receives molten metal from the sprues 36, a gate web 38 extending substantially throughout the periphery and relatively narrow in cross section, which connects the ring sprue 37 and the periphery of the bell portion 34 of the casting. Risers 39 are shown as extending upwardly from the upper portion of the casting. In Fig. 2 there is shown a metallic insert 24 which is cast into the upper end of the casting, which insert may be of copper or other suitable material. Where such insert is not formed in the casting, a single central riser may be employed instead of the three risers 39 shown in Fig. 2. It will be noted, furthermore, that the sprues 36 are located directly opposite the wings 35, whereby the molten metal will flow more readily into the portions of the mold cavity in which the wings 35 are formed.

With the sprue arrangement illustrated in Fig. 2, it will be apparent that molten metal is introduced throughout the periphery of the bell portion 34 simultaneously whereby the casting cavity will be filled rapidly before the solidification of the large areas of thin metal commences.

The manner of forming the sprue, gate and riser cavities is best illustrated in Figs. 1, and 4 to 7, in which the upstanding sprues 36 are formed in sprue cavities 36^a in the abutting faces of the mold sections 3. It will be seen that the sprue cavities 36^a of one mold section register with sprue cavities 36^a of an adjacent mold section to form the cavities within which the sprues 36 are formed. It will be obvious, of course, that the sprue cavities might be formed entirely in one of

the mold sections instead of partly in each of two mold sections as illustrated. The sprue cavities 36ª communicate directly with the registering ring sprue cavities 37ª and 37ᵇ formed in the abutting edge portions of the mold sections 3 and the base plate 2 respectively, and as will be seen particularly in Figs. 4 and 7, the ring sprue cavities 37ª and 37ᵇ extend throughout the periphery of the mold. As seen perhaps most clearly in Figs. 4, 6 and 7, the ring sprue cavities communicate directly with the base of the casting cavity through a gate 38ª which is relatively narrow in cross section and which communicates with the casting cavity throughout the entire periphery thereof.

The riser cavities 39ª are formed in the respective mold sections 3 and communicate with the casting cavity adjacent the top portion thereof.

In Figs. 8 to 14, I have illustrated a modified form of mold arranged to form a dolly casting having two hollow wings. The casting 52 to be formed in this modified form of mold is shown in Figs. 10 and 11 and comprises a central hollow stem 41, a lower bell or flange portion 42 and hollow wings 43 projecting up from the bell or flange and disposed radially with respect to the stem.

The mold illustrated in Figs. 8 and 9 is shown as comprising a supporting base 44 upon which is mounted an apertured plate 45. A pair of movable mold sections 46 are associated with the base 44 and are so formed as to define the exterior surfaces of the casting to be formed in the mold. Pintles 47 are shown as extending through the knuckle portions 48 of the mold sections, and bearing brackets 49 secured to the base 44 whereby the mold sections 46 may be moved pivotally with respect to the mold base.

The pintles 47 are fixed to the knuckles of the mold sections, whereby the mold sections turn with the pintles and a lever 50 is secured to each of the pintles 47 for swinging the mold sections. A core 51 having lateral wings 52 is shaped to conform to the interior of the stem 41 and wings 43 of the casting and is preferably hollow, having a central recess 53 to diminish the weight and heat conductivity of the core. The core includes a top member 54 which is shaped to define the upper portion of the interior of the casting and which is secured to the main body of the casting by a threaded connection 55. The core 51 is movable vertically within the central aperture of the plate 45 and is secured upon a base member 56 by means of a retaining plate 57 which is so disposed as to engage the under side of the plate 45 to limit upward movement of the core.

The core is guided by means of a vertical pin 58 secured in a central boss 59 on the base member 56 and slidable in a boss 60 formed integrally with the base. The lower edge of the boss 59 engages the upper end of the boss 60 of the base to limit downward movement of the core. The outer surface of the pin 58 is provided with a threaded portion 61 engageable with internal threads of a helical gear 62 which meshes with a helical gear 63 on a transverse shaft 64 which is provided with a lever arm 65 by which it may be rotated to drive the gear 62 to raise or lower the core.

Fig. 10 illustrates the manner in which casting metal is introduced into the mold cavity, the casting having sprues 66 adjacent the outer ends of the wings 43, said sprues being connected to a ring sprue 67 surrounding the entire periphery of the bell or flange 42 of the casting and communicating with the periphery of the bell or flange portion of the casting by a relatively narrow peripheral gate web 68. A riser 69 is shown extending upwardly from the central top portion of the stem 41 of the casting. The mold sections 46 are suitably recessed along adjoining edges to form the gate, casting and riser cavities. Thus the recesses 66ª co-operate to form the sprue cavities for forming the sprues 66, the recesses 67ª and 67ᵇ in the mold sections 46 and base plate 45 co-operate to form the ring sprue cavity which communicates with the sprue cavities. Arcuate projections 70 on the mold sections closely overlie the plate 45 entirely around the edge of the central aperture to form relatively narrow peripheral gates between the ring sprue cavity and the base of the casting cavity. Recesses 71 in the mold sections are suitably shaped to define the exterior surface and contour of the finished casting and recesses 69ª co-operate to form the riser cavity which is shown in this modification as extending upwardly from the top of the stem forming portion of the casting cavity.

In carrying out the casting operation with either of the molds illustrated and described, the mold sections are first adjusted to closed position and the core moved upwardly into molding position. Molten casting metal, for example, a light alloy of aluminum, is then poured simultaneously into the sprue cavities. This molten casting metal runs from the sprue cavities or equivalent means into the ring sprue cavity from whence the said casting metal flows through the gate and is introduced into the casting cavity throughout substantially the entire periphery thereof. The casting metal flows upwardly through the casting cavity and outwardly into the riser cavity or cavities. From the ring sprue cavity there is thus provided a simultaneous and continuous supply to the lower flange or bell portion of the casting, whereby the shallow casting cavity of relatively great area may quickly be filled with molten casting metal before said metal has an opportunity to chill and produce voids and cold shuts. The

molten metal in the sprue cavities directly adjacent and opposite the wing portions of the casting cavites heats the portions of the mold adjacent to the relatively thin wing sections and thus assists in preventing undue chilling of said thin wing sections. The presence of the molten metal in the ring sprues furthermore provides a source of heat to prevent too rapid chilling of thin bell or flange of the casting and thus assists materially in the production of good sound castings. Furthermore, with the particular type of casting illustrated involving large areas of thin section, the introduction of the casting metal substantially simultaneously throughout the periphery of the casting cavity makes possible the ready production of such castings in permanent molds with the attendant advantages of smooth surface finish and desirable physical proportions

While the ring sprues and gate portions are shown as of completely peripheral extent, it will be understood, of course, that the advantages of my invention may be obtained by making the ring sprue and gate of substantially peripheral extent, although I prefer in general that they be of completely peripheral extent.

It will thus be seen that I have provided a method and mold particularly applicable to the casting of articles having a relatively large extent of thin section, and whereby air may be readily expelled from the entire casting cavity ahead of the casting metal to permit the casting cavity to be readily filled with said casting metal.

It will further be seen that I have provided an advantageous mold whereby molten casting metal may be introduced simultaneously over a relatively large area into the casting cavity. Thus the ring sprue cavity surrounds, and the gate communicates with, a major portion of the periphery of the casting cavity.

It will further be noted that I have provided an extremely advantageous method and mold for forming castings from metal of relatively low melting point and high crystallization shrinkage in permanent molds to form castings of thin section and of relatively great surface area.

It will further be noted that I have provided an advantageous mold for the casting of washing machine dollies and articles of similar nature in permanent molds from metal of relatively high crystallization shrinkage and low melting point.

It will be seen that my invention is particularly advantageous in permitting the rapid introduction of molten metal into the casting cavity to prevent voids and cold shuts in a casting formed in a mold having a natural high heat conductivity and chilling effect upon said casting metal.

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. A mold for casting, from aluminum alloys and the like, thin walled articles having a widened base portion, said mold having a casting cavity, the base portion of which is horizontally disposed, a sprue cavity extending around substantially the entire periphery of said base portion of the casting cavity and communicating therewith through a narrow gate extending substantially throughout the periphery thereof, whereby casting metal may be introduced into said base portion simultaneously through substantially the entire periphery thereof, said mold members being also recessed to provide means through which metal may be supplied to said ring sprue cavity.

2. A permanent mold for casting an article having thin portions of relatively great surface area comprising a plurality of separable permanent mold members recessed to define a casting cavity and a ring sprue cavity surrounding the periphery of said cavity and a relatively narrow gate intermediate said ring sprue and casting cavities and extending substantially throughout the periphery to introduce casting metal simultaneously into the entire periphery of said casting cavity, said mold members being further recessed to provide sprue cavities through which casting metal may be introduced into said ring sprue cavity.

3. A permanent mold for forming thin walled castings having a base portion and an upstanding portion projecting from said base portion comprising a plurality of separable mold members recessed to define a casting cavity in which the portion of the cavity for forming the base portion of the casting is substantially horizontally disposed and the portion of the cavity for forming the upstanding portion of the casting extends substantially vertically upwardly from the portion of said cavity defining the base portion, said mold sections being recessed to provide a continuous ring shaped sprue cavity surrounding the periphery of said base portion, a relatively narrow peripheral gate communicating with said sprue cavity and with substantially the entire periphery of said base portion, said mold members being further recessed to provide a plurality of sprue cavities through which casting metal may be fed simultaneously to said ring sprue cavity, whereby molten casting metal may be fed simultaneously into the entire periphery of said base portion and flow through the base portion of the casting cavity upwardly

into the upwardly projecting portion of the cavity.

4. A mold for forming a thin walled casting having a substantially horizontal base portion, a hollow stem extending upwardly from said base portion and wing portions extending upwardly from said disc portion, said mold comprising a plurality of permanent mold members shaped to define a casting cavity with said base portion in a horizontal position and said stem portion in upstanding position, said mold having peripheral ring sprue cavity extending around the periphery of said base portion, a relatively narrow gate portion communicating with said ring sprue cavity and with substantially the entire periphery of said base portion of the casting cavity and sprue cavities arranged so that casting metal may be supplied simultaneously therethrough to said ring sprue, said sprue cavities being disposed opposite said wing cavities to provide an adequate supply of metal to said wing cavities and to heat the portions of the mold adjacent said wing cavity, and a core arranged to be moved upwardly intermediate said mold members to form said hollow stem portion.

5. A mold for casting a hollow thin walled article having a centrally disposed hollow stem, a peripheral base flange extending outwardly from the stem and wings projecting upwardly from the flange and disposed radially with respect to the stem, said mold having a casting cavity shaped to conform to the surfaces of the casting, a ring shaped cavity extending around the periphery of the flange and wing forming portion of the casting cavity, a continuous narrow gate between the ring cavity and the casting cavity extending throughout the circumference of the ring cavity and of the flange forming portion of the casting cavity and a sprue cavity extending upwardly from the ring cavity to the top of the mold adjacent the end of each wing forming portion of the casting cavity.

6. A permanent mold for forming castings from aluminum alloys and the like, comprising a plurality of separable mold members recessed to define a casting cavity, said mold sections being further recessed to define a sprue cavity surrounding a major portion of the periphery of the base of said casting cavity, and to define a relatively narrow gate intermediate the sprue cavity and casting cavity communicating with a major portion of the periphery of the base of said casting cavity, whereby the air within said casting cavity may be driven out ahead of the casting metal and whereby the casting cavity may be readily filled with casting metal.

7. A permanent mold for forming castings from aluminum alloys and the like, said mold having a casting cavity, a sprue cavity extending around the major portion of the periphery of the base of said casting cavity, and a gate substantially co-extensive with said sprue cavity and communicating with said casting cavity at substantially its lowest portion, whereby air may be readily expelled from the entire casting cavity and whereby said casting cavity may be readily filled with molten casting metal, said mold being further recessed to provide means for casting metal to enter said sprue cavity.

In testimony whereof I affix my signature.

EVERETT G. FAHLMAN.