

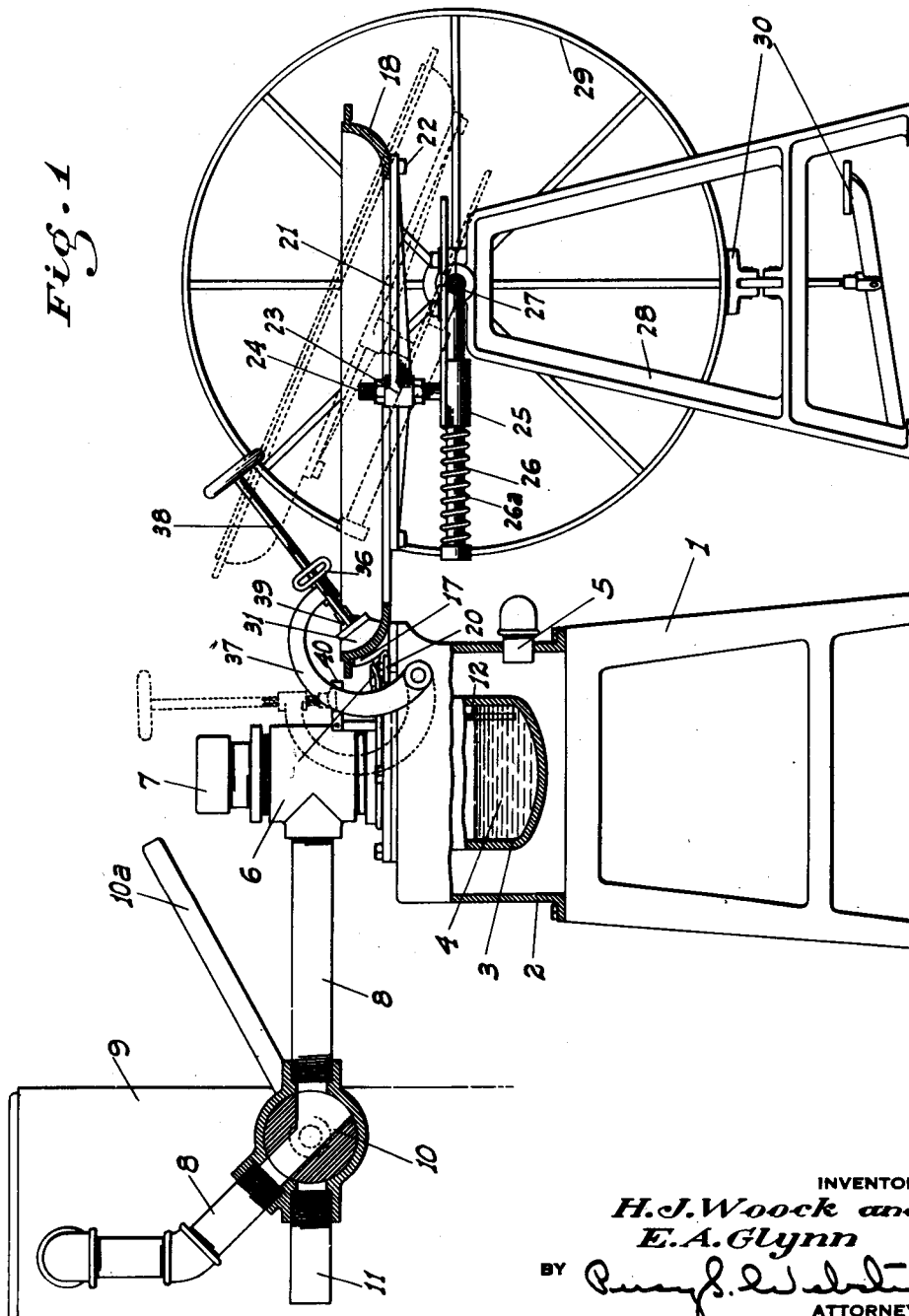
Jan. 29, 1935.

H. J. WOOCK ET AL

1,989,438

METHOD OF AND APPARATUS FOR DIE CASTING

Original Filed March 8, 1929 3 Sheets-Sheet 1



INVENTORS
H. J. Woock and
E. A. Glynn
BY *Wm. J. Webster*
ATTORNEY

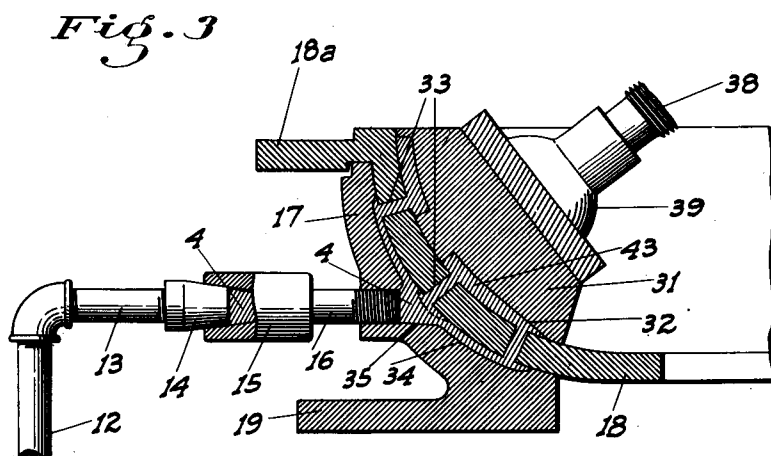
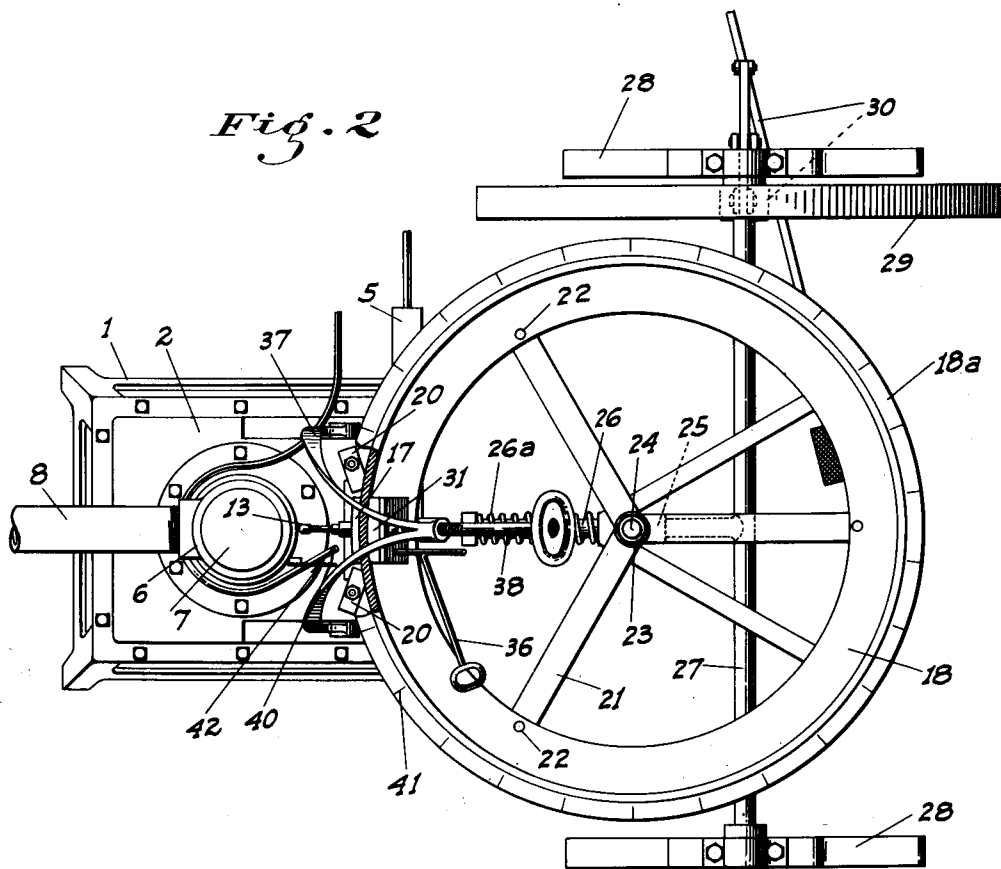
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H. J. WOOCK ET AL

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METHOD OF AND APPARATUS FOR DIE CASTING

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INVENTORS

*H. J. Woock and
E. A. Glynn*

BY

Curry J. Webster
ATTORNEY

Jan. 29, 1935.

H. J. WOOCK ET AL

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METHOD OF AND APPARATUS FOR DIE CASTING

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Fig. 4

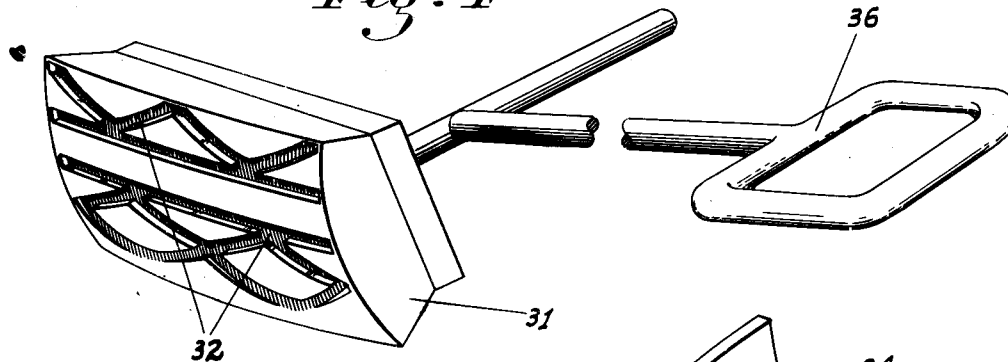


Fig. 5

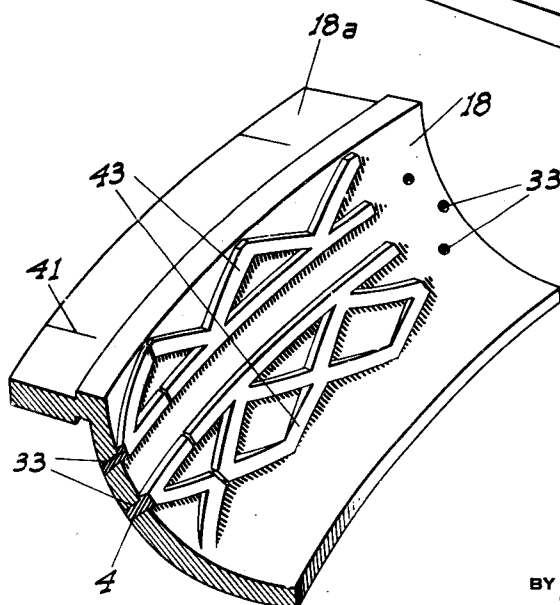
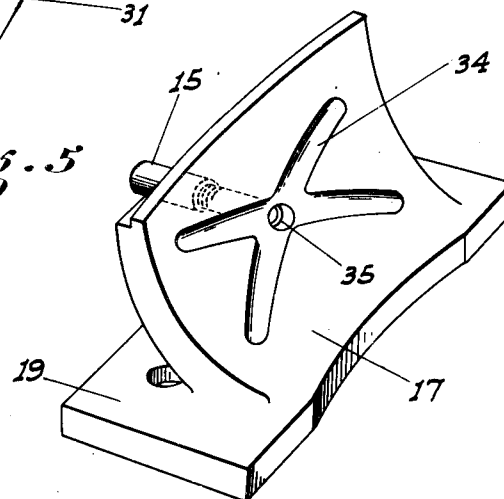


Fig. 6

INVENTORS

*H. J. Woock and
E. A. Glynn*

BY

Charles D. Webster
ATTORNEY

UNITED STATES PATENT OFFICE

1,989,438

METHOD OF AND APPARATUS FOR DIE CASTING

Herbert J. Woock and Edwin A. Glynn, Lodi, Calif., assignors to Super Mold Corporation, Lodi, Calif., a corporation of Nevada

Continuation of application Serial No. 345,382, March 8, 1929. This application October 17, 1932, Serial No. 638,194

23 Claims. (Cl. 22—203)

This invention relates to die casting and particularly to the forming of a tire-tread design on a matrix to be used in connection with the retreading of old tires or the manufacture of new tires, and is a continuation of our application No. 345,382, filed March 8, 1929.

In making such a matrix it has previously been necessary to form the initial casting die or pattern from which the matrix is made with the complete tread design pattern cut therein. This is obviously a very slow and costly method, since the design must of course be uniform from end to end in order to present the proper appearance on the finished tire.

One of the objects of our invention is to avoid the objectionable features of the above method by providing for the making of the matrix by means of a die only a few inches in length, with the aid of a casting apparatus of such a nature that with this small die the desired design may be cast on the matrix around the entire extent thereof in half an hour or less.

Another object is to arrange for the pouring of the die casting metal into the die from the back of the matrix, instead of through the back of the die; and with the use of high pressure. This not only prevents the formed design from being defaced by any protruding metal nubs as is the case when the metal pouring openings lead to the die direct and which require subsequent chipping or filing down to remove them; but enables the cast metal to be firmly anchored to the matrix, apart from the natural adhesion of the casting metal for the matrix metal. This method of forming the design on the matrix enables the matrix itself to be a smooth surfaced element which may very easily be cast and turned or finished over its entire surface prior to the casting process being carried out. The use of pressure on the molten casting metal causes such metal to properly fill the cut design in the die in a very quick manner and insures the said metal having the desired density and freedom from air holes or other blemishes.

Our improved apparatus and method also permit the use of a normally unheated and at all times relatively cold matrix blank so that said blank will not tend to become warped out of round during the casting operations and can be manually handled at any time without having to resort to artificial cooling means to avoid warping of the matrix or burning of the operator.

Our method has other great advantages in that it permits the use of a single standard size and shape of matrix blank in forming the tread pat-

tern of any number of different makes of tire of the same size, and also enables the main structural features of the apparatus to be used for any and all sizes of matrix blank. The only parts which have to be changed for any different sized blanks or different designs are the die itself and the metal distributing shoe which is placed back of the matrix during the metal pouring and casting operations.

Though the apparatus has been particularly designed and will be described for use in connection with the forming of tire matrices our die casting process may be used in forming any other parts for which it may be adapted.

A further object of the invention is to provide a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects we accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Fig. 1 is a side elevation of our die casting apparatus as in operation partly broken out.

Fig. 2 is a top plan view of the same.

Fig. 3 is an enlarged cross section of the matrix, the die and distributing shoe as in cooperating relationship with each other, and showing the casting metal as forced into the die.

Fig. 4 is a perspective view of the die detached.

Fig. 5 is a perspective view of the distributor shoe detached.

Fig. 6 is a fragmentary perspective view of the matrix with a portion of the design cast thereon.

Referring now more particularly to the characters of reference on the drawings the numeral 1 denotes a rigid stand on which a heating chamber 2 rests. A melting pot 3 to contain a supply of molten die casting metal 4 of a special relatively hard nature, depends into this chamber. The metal is retained in the necessary molten condition in the pot by a gas blow pipe 5 or some similar device which projects into the chamber 2 to direct the flame or heat against the pot. A vertical pipe 6 provided on top with a removable cap 7 projects upwardly from the pot and is secured thereto with a pressure-tight fit. An air pressure line 8 leads from one side of the pipe 6 to a compressed air tank 9. A three-way valve 10 is interposed in the line so as to control the feeding of air from the tank to the pot or from the pot to the atmosphere through an exhaust pipe 11. This valve is pro-

vided with a suitable operating handle 10a so as to be easily turned from one position to the other. The provision of the removable cap 7 on top of the pipe enables a fresh supply of metal to be poured into the pot at any time without removing the pipe as a whole and without interfering with the obtaining of the necessary pressure-tight conditions within the pipe and pot.

Depending into the pot on the side closest to the heating means is a relatively small pipe 12 which projects upwardly through the top of the pot and terminates in a horizontal extension 13 fitted on its outer end with a tapered nose 14. This nose is adapted to removably wedge into a sleeve 15 provided on one end of a horizontal nipple 16 which is secured to the metal distributing shoe 17. This shoe is in the form of a short segment of the matrix blank 18 and is adapted to closely engage the outer convex surface of said blank both circumferentially and cross sectionally for a short portion of the circumferential extent of the matrix.

The shoe 17 has a flat base 19 to rest on the chamber 2 in front of the pipe 6, to which chamber the shoe is removably secured by suitable clamping plates 20. The particular wedging fits between the relatively fixed pipe 13 and the removable shoe provides for the ready separation of these parts when necessary without the use of a union or other form of screw coupling which would become clogged with molten metal, while at the same time giving the tight fit necessary.

The matrix blank 18 is a complete circular ring of substantially semi-circular form in cross section, so that two matrices when placed together in abutting face to face relation conform to the circumference and cross sectional contour of a tire of a certain size and enclose the tread portion thereof. The matrix when used is inserted in a tire retreading or forming mold such as that shown in Patent No. 1,710,804, dated April 30, 1929.

This blank 18 is made of aluminum or similar metal finished so that its outer or inner curved surfaces are perfectly smooth. To support the blank in proper position relative to the distributing shoe 17, so that the axis of the blank will be normally vertical and concentric with the shoe, we provide spider arms 21 adapted to pass under and support the matrix, and to be removably secured thereby by bolts 22. These arms radiate from a vertical hub 23 which is vertically adjustable and turnable on a spindle 24 which projects upwardly from a sleeve 25. This sleeve is slidable but non-turnable on an arm 26 projecting radially toward the shoe 17 from a horizontal shaft 27 turnable in bearings 28. A spring 26a about the arm acts on the sleeve to draw the same away from the outer end of said arm and shoe. The shaft and arm are so positioned relative to the stand 1 that the arm is radial with the circumferential plane of the shoe 17 when the latter is secured in place.

When the hub 23 is properly adjusted on the spindle with regard to the particular shoe 17 being used the peripheral matrix flange 18a rests on the top of the shoe as shown in Fig. 3 when the outer surface of the matrix is closely engaged with the adjacent face of the shoe.

The shaft 27 on one end is provided with a hand wheel and brake drum 29 with which a foot brake structure 30 of suitable character is associated, so that the shaft may be easily turned by hand if desired, or may be held in any position by the brake.

The die block 31 is adapted to engage the inner concave face of the matrix 18 both circumferentially and transversely and is substantially the

same length as the shoe 17. The convex or matrix engaging face of the block is cut with grooves 32 to provide the necessary tread design pattern of the tire, said grooves being closed to the edges of the block. All tread design patterns are formed of a number of short repeated patterns, so that it is only necessary to make the die block long enough to take in one complete pattern section or unit, which of course cuts down the expense of die making, which is very costly labor. Whatever the circumferential length of the die may be it must obviously however be such as to be evenly divisible into the total circular extent of the matrix.

Holes 33 are drilled through the matrix 18 throughout its circumferential extent, these holes being located in the plane of the different die grooves 32. This drilling is done before commencing casting operations and the arrangement of holes will of course be different for each different pattern design. The matrix engaging face of the shoe 17 is grooved at 34 in radiating relation to and communicating with the opening 35 therein which connects with the nipple 16, said grooves being arranged so as to communicate with all the matrix holes 33 which are provided for each pattern section and which are covered by the die block 31.

Since, as above stated, the arrangement of holes must be different for the different tread designs, the shoe groove arrangement must be different also, necessitating the use of a different shoe for each different tread, as well of course as a different die. These two parts however are the only members of the entire apparatus which have to be changed when casting different designs or when using matrix blanks of different sizes. The die block 31 is preferably provided with a handle 36 projecting from the outer face thereof at one end so that it may be manipulated from one side of the matrix 18. To clamp the die block, matrix and shoe 17 firmly together a substantially U-shaped clamp frame 37 is pivoted on the chamber 2 in straddling relation to the shoe, said frame at its outer end carrying a hand turned screw 38 having a clamping head 39 to engage the outer end frame face of the die block 31 centrally between its ends. This frame is so proportioned and positioned that when the head is clampingly engaged with the die the screw 38 will be then substantially radial with the curved face of the die both circumferentially and transversely, so as to exert the most even and efficient clamping action on the die.

To heat the shoe 17 when casting operations are being carried out and to also impart a certain amount of heat to the adjacent portion of the matrix 18, a small gas torch nozzle 40 is positioned so as to direct its flame against the back of the shoe adjacent the nipple, as shown in Fig. 2. This also imparts heat to the adjacent portion of the matrix itself, apart from the heat of the molten metal, so that better adhesion of such metal to the matrix is obtained than would otherwise be the case. To insure the correct position of the matrix 18 relative to the shoe 17 when the matrix is turned from one position to another the flange 18a of the matrix is radially scribed at evenly spaced intervals as at 41, said marks being spaced apart the length of the shoe 17 and being adapted to register with a fixed pointer 42 on the top of the chamber 2.

In operation the matrix 18 which is first drilled and scribed for the particular die 31 and shoe 17 to be used is clamped onto the spider, the spindle 24 being then axially of the matrix. One operator

standing behind the matrix 18 grasps the same or the spider so that the matrix may be pressed forward toward the shoe 17 and lowered to place the same in cooperating relation with said shoe; turning the matrix the extent necessary to aline one of the scribed marks with the pointer. During this operation the clamping frame is swung up and back out of the way. Another operator manipulating the die 31 then places the same against the inner face of the matrix in proper relationship to the shoe. While this operator holds the die in position by the handle the first operator manipulates the clamp to clamp the shoe, matrix and die in closely associated relation.

The air valve 10 is then opened, the relatively large size of the valve and air pipes causing a great volume of air to instantly enter the metal pot, which in turn causes an instant discharge of metal under pressure from said pot through the pipe 12 and connected parts into the shoe 17. From the shoe the metal is instantly discharged along the grooves 35 and forced through the matrix holes 33 and into the die grooves 32. Due to the high pressure used and the relatively small area of the die grooves, the passage of the metal from the pot to all parts of the die is almost instantaneous and the valve 10 need be held open only for a second or so. Also on account of this pressure it is not necessary to provide the die with air vent or bleed holes, since whatever air is confined in the grooves in the die is compressed into such a small area as to have a negligible effect on the poured metal and upon moving the valve 10 to its normal position the pressure in the pot is instantly released to the atmosphere.

The metal in the matrix 18 sets at once and the clamp is then removed to permit the die to be drawn away from the matrix, the metal previously poured into the die 31 adhering to the matrix in the form of a raised pattern, as shown at 43. The exposed surface of this pattern will be perfectly smooth throughout, since as above stated no vent holes from the die are provided to cause projecting nubs of metal to be formed. The die block 31 is of a metal for which the casting metal has relatively little affinity and said block is therefore easily released by tapping the same lightly with a hammer. The matrix operator then tilts the matrix 18 upwardly, causing the metal behind the matrix to be sheared off from the main supply still present in the shoe 17 and supply pipe. The back of the matrix will then prevent a roughened condition due to some of this metal adhering to the same, but this may be easily removed by chipping or grinding the same off.

The matrix is then rotated to aline the next scribed mark with the pointer, lowered to again cooperate with the shoe 17 and the die 31 is again placed in position and clamped in connection with the matrix to enable the next pattern section to be cast. With a trained force the different cycles of operation may be carried out in such rapid sequence that it is easily possible to completely cast the tread pattern in a matrix in less than half an hour.

The compositions of the matrix metal and that of the casting metal are such that the two have considerable affinity for each other, so that the adhesive force between the two is quite great. Such adhesion however is materially aided by the heat from the torch 40, as previously stated, and by the anchoring of the cast metal to the matrix by reason of the holes 33, which of course

remain filled with the casting metal and are integral with the cast design itself.

It is to be noted that except for the die grooves 32, the entire area of the convex face of the die 31, flatly engages the inner face of the matrix 18. By this arrangement, the only metal added to the matrix with the pouring operation is that necessary to form the design ridges or protrusions 43; the original surface of the matrix thus forming part of the completed design.

From the foregoing description it will be readily seen that we have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described our invention what we claim as new and useful and desire to secure by Letters Patent is:

1. A casting apparatus for use with a perforate blank comprising a distributing shoe, means to support the blank against the shoe, the shoe having a single orifice and grooves in its working face radiating from the orifice to coincidence with the perforations in the blank, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

2. A casting apparatus for use with a perforate blank comprising a distributing shoe, means to normally support the blank adjacent to but slightly spaced from the shoe and being yieldable to permit the blank to be moved against the shoe, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

3. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank, a yieldable means normally acting on the support to hold the blank spaced from the shoe but adapted to permit the blank to be moved against the shoe, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

4. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank including a shaft and a sleeve slidable thereon, a yieldable member normally acting on the sleeve to move it away from the shoe, the blank being movable with the sleeve whereby it may be pressed against the shoe, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

5. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank including a shaft and a sleeve slidable thereon, a yieldable member normally acting on the sleeve to move it away from the shoe, the blank being movable with the sleeve whereby it may be pressed against the shoe, means to turn the shaft through an arc at right angles to its longitudinal axis, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

6. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank including a shaft and a sleeve thereon, a yieldable member normally acting on the sleeve to move it away from the shoe, the blank being movable with the sleeve whereby it may be pressed against the shoe, the shaft being fixed to a turnable shaft at right angles thereto, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

7. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank including a shaft and a sleeve thereon, a yieldable member normally acting on the sleeve to move it away from the shoe, the blank being movable with the sleeve whereby it may be pressed against the shoe, the shaft being fixed to a turnable shaft at right angles thereto, a brake to hold the second shaft against rotation, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

8. A casting apparatus for use with a perforate blank comprising a distributing shoe, a support for the blank comprising a rotatable member to support the blank and operable to position one surface of the blank progressively against the distributing shoe, and means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design on the face of the blank.

9. In a casting apparatus a support, a melting pot supported thereby, means to alternately apply fluid pressure to the pot and relieve same therefrom, a distributing shoe, a passage means from the pot to the shoe, and means to position a blank against the shoe in a manner whereby molten material forced from the pot through the shoe will be spread upon the face of the blank.

10. A casting apparatus for use with a perforate blank comprising a distributing shoe, means to support the blank against the shoe, means for maintaining the shoe at a high temperature, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

11. A casting apparatus for use with a perforate blank comprising a distributing shoe, means to support the blank against the shoe, a blow torch directed at the shoe, means to distribute molten material through the shoe and perforations in the blank, and means to mold such material into an arbitrary design upon the face of the blank.

12. A casting apparatus for use with a perforate blank comprising a support, a distributing shoe carried by the support, means to support a blank against the shoe, a frame pivoted relative to the shoe support, a die, means carried by the frame to clamp the die against the blank opposite the shoe, and means to introduce molten material through the shoe and perforations in the blank to the space between the adjacent faces of the blank and die.

13. A casting apparatus for use with an annular perforate blank, comprising a distributing shoe, means to support the annular blank and to progressively advance the blank into contact with the shoe, a separate die, means to position the die against the blank opposite the shoe, and means to introduce molten material through the

shoe and perforations in the blank to the space between the adjacent faces of the blank and die.

14. In a mold-forming apparatus, the combination of means for holding a mold section, a die member, and means for successively positioning said die member with a part thereof in spaced relation to different portions of said mold section to form die cavities for casting recurring pattern-molding units in said mold section.

15. In mold-forming apparatus, the combination of means for holding a mold section, a die member, means for successively positioning said die member with parts thereof in spaced relation to different portions of said mold section to form die cavities for casting pattern-molding units in said mold section, and means for supplying molten metal to said die cavities.

16. In mold-forming apparatus, the combination of means for supporting a mold section having a molding face formed therein, a die member, means for successively positioning said die member with a part thereof in spaced relation to different portions of said molding face to form die cavities for casting pattern-molding units in said mold section, means for supplying molten metal to said die cavities, and means for preventing relative movement between said mold section and said die member during the casting operations.

17. In mold-forming apparatus, the combination of means for holding a mold section having a molding face formed with an annular recess therein, a die member, means for successively positioning said die member with a part thereof in spaced relation to the bottom of said recess to form die cavities for casting pattern-molding units in said mold section, and means for supplying molten metal to said die cavities.

18. The method of making a mold pattern comprising pouring molten metal in the form of a pattern directly onto one face of a mold blank, and subjecting the blank, while the metal is being poured, and in the zone of pouring, to the influence of heat other than that of the molten metal itself.

19. The method of making a mold which comprises forming a mold blank, successively using different and contiguous portions of the surface of said blank in conjunction with a die member to form therewith, in succession, a series of individual casting dies, and supplying molten metal to the casting dies as each is formed to cast recurring and continuous pattern-molding portions in place in said mold blank.

20. A method of die casting a raised pattern onto a blank, said pattern when complete comprising a plurality of duplicated pattern sections; said method comprising placing a die against one face of the blank to form, with said blank, a casting cavity having the configuration of a single pattern-section, pouring the die-cast metal into the cavity, shifting the die along the blank to a position such that the formed cavity will lie immediately adjacent the poured pattern-section, again pouring the metal into the die to form a second pattern section on the blank, and repeating the operations until the complete pattern has been formed.

21. The method of making molds which comprises forming a mold blank, successively using different regions of one surface of said blank in conjunction with a die member to form therewith, in succession, a series of individual casting dies, and supplying molten metal to the dies as they are successively formed to cast recurring pattern-molding portions in place in said mold blank.

22. The method of making molds which comprises successively positioning a die member relative to different contiguous regions of the surface of a mold blank to form successive die cavities, and supplying molten metal to each cavity as it is formed for casting a succession of pattern-molding portions in place in said mold section.

23. The method of making molds which comprises supporting a die member and a body for relative movement, causing relative movement between said body and said die member to position the latter relative to a portion of said body to form a casting die therewith, supplying molten

metal to the die thus formed to cast an initial pattern-molding portion in place on the body, causing further successive relative movements between said body and said die member to successively position the latter relative to different portions of said body and in substantially abutting relation to the previously cast pattern molding portion to form in succession, a series of casting dies, and supplying casting metal to each casting die as it is thus formed to cast a continuous series of pattern molding portions in place on the body.

HERBERT J. WOOCK.
EDWIN A. GLYNN.