May 2, 1939. D. J. CAMPBELL 2,156,523

METHOD OF MOLDING

Original Filed Dec. 3, 1934 3 Sheets-Sheet 1

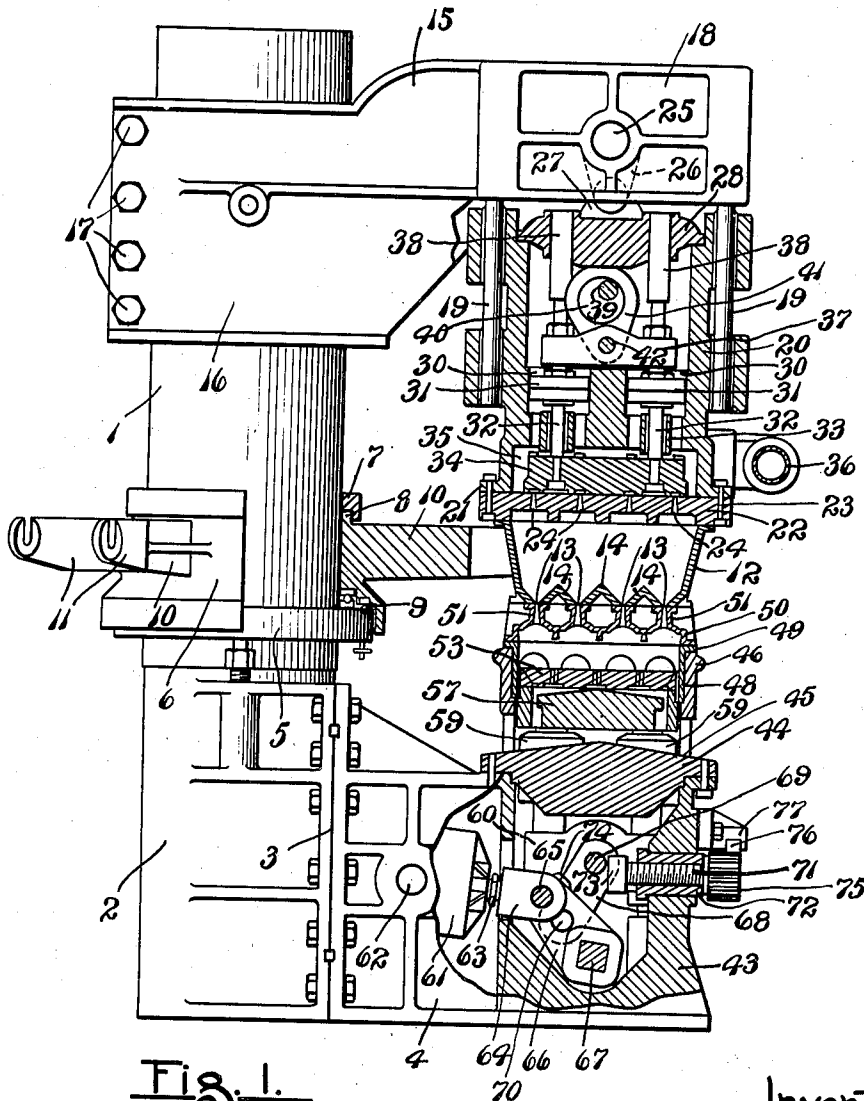


Fig. 1.

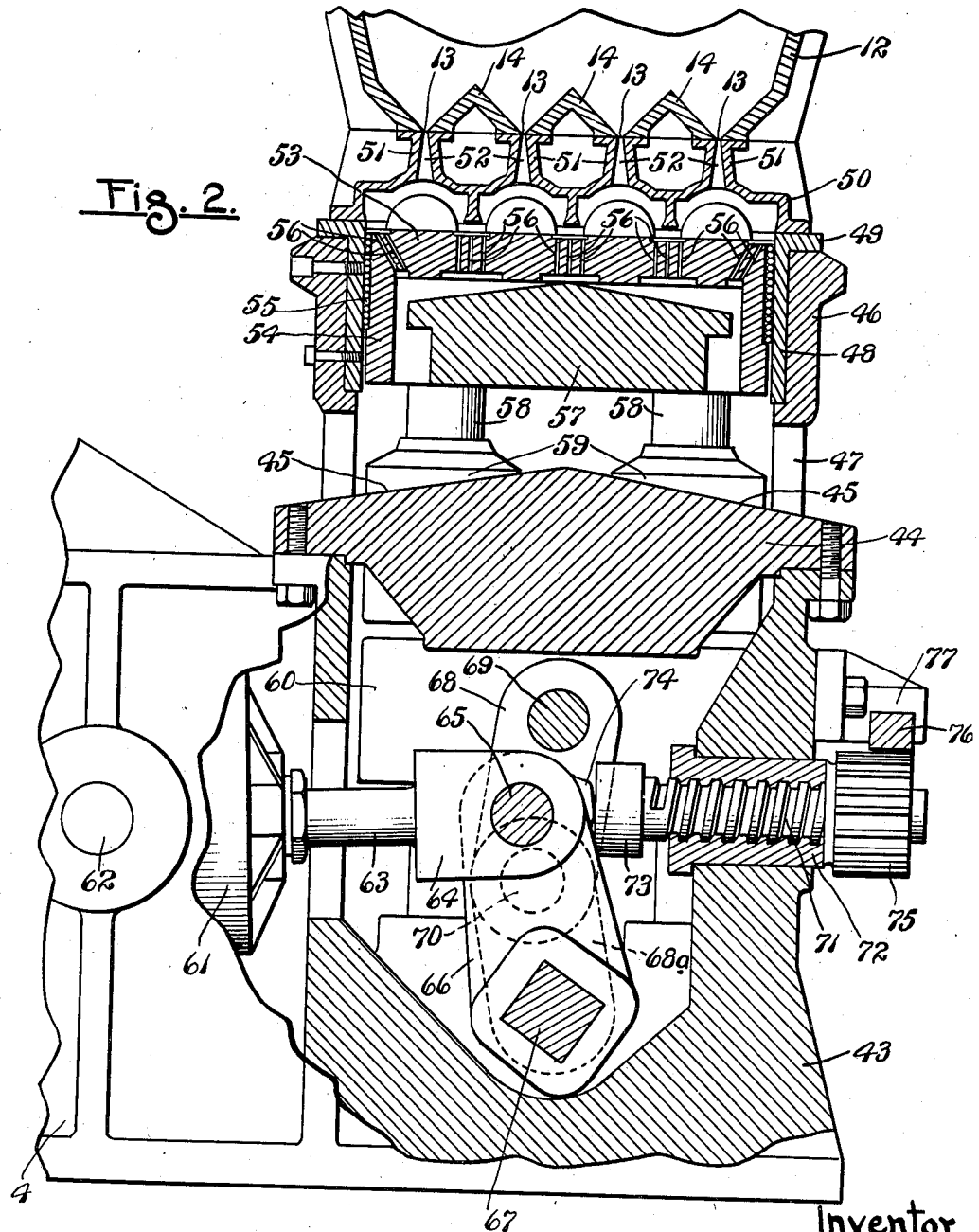
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Fig. 2.



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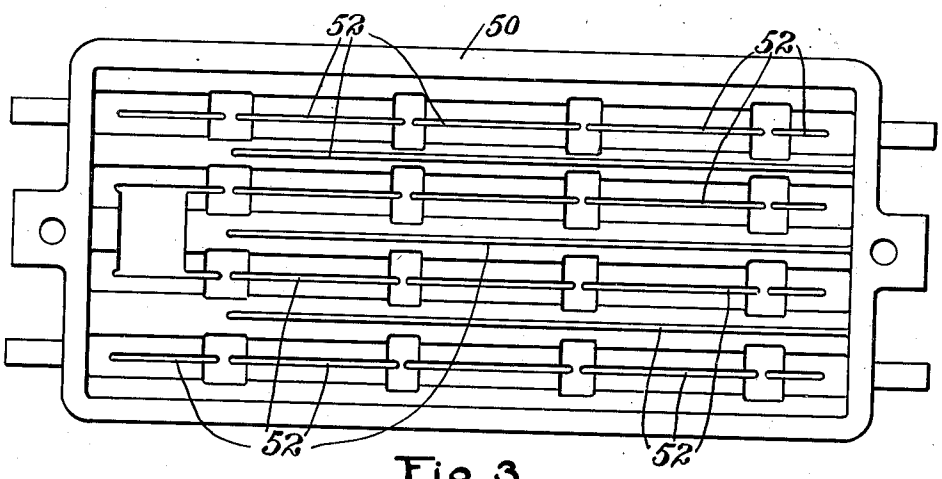


Fig. 3.

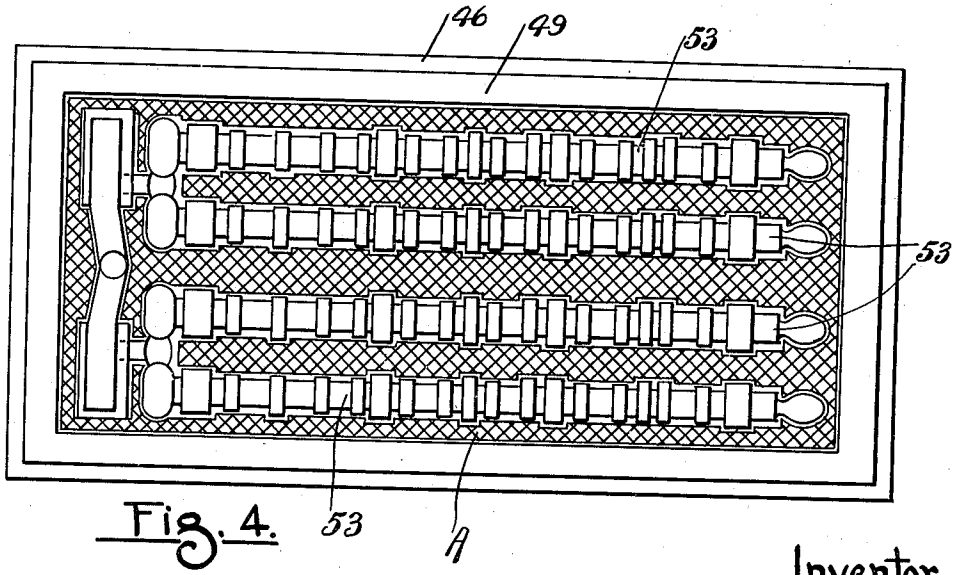


Fig. 4.

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UNITED STATES PATENT OFFICE

2,156,523

METHOD OF MOLDING

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Original application December 3, 1934, Serial No. 755,688. Divided and this application March 18, 1935, Serial No. 11,568

1 Claim. (Cl. 22—193)

This invention relates to a novel method of molding, whereby molds for the casting of metal forms may be very quickly and economically produced. The present application is a division of my pending application, Serial No. 755,688, filed December 3, 1934 for Molding machine.

The invention will be fully explained in the following description, and the many objects and purposes and a practical way for carrying out the method of this invention described, which may be understood from said description, taken in connection with the accompanying drawings, in which:

Fig. 1 is an elevation of a molding machine by means of which the novel method is practiced, the structure of the machine being the subject matter of the above identified, prior filed application.

Fig. 2 is a fragmentary enlarged vertical section, showing the match plate and the patterns carried thereby in the position which they occupy when sand is forced into the flask over said patterns.

Fig. 3 is an under plan view of the flask used, and

Fig. 4 is a plan view of the match plate and patterns over which the flask is placed.

Like reference characters refer to like parts in the different figures of the drawings.

A machine which I have constructed and which is usable practically for attaining the method of my invention is shown in Figs. 1 and 2 of the drawings. In construction a vertical supporting column 1 of cylindrical form at its upper portion, has a lower portion indicated at 2 which is provided with a vertical front face against which a housing 4 for a part of the mechanism is located and bolted in place. Near the lower end of the cylindrical section 1 of the supporting column a supporting collar 5 is secured, carrying anti-friction bearings over which there is mounted a rotatable ring 6 which has a downwardly extending skirt extending nearly to the lower edge of the collar 5 to protect the anti-friction bearing from entrance of sand or dust. A retaining collar 7 with a downwardly extending annular lip is secured to the column 1 over the upper end of the ring 6, which has an annular lip or flange 8 received within the downwardly extending annular lip of the collar 7. A releasable latch 9 is carried by the collar 5 and is adapted to engage in suitable spaced apart recesses in the ring 6 to thereby stop the same with the parts which it carries (later described) as predetermined positions.

From the ring 6 at spaced apart intervals arms or supports 10 extend radially outward, preferably three in number. At the outer end of each arm are two spaced apart yoke arms 11 equipped with receiving sockets near their ends. A sand hopper 12 has oppositely extending trunnions received in said sockets in the arms 11, so that with three of said pairs of yoke arms 11 three hoppers 12 are used.

Each of the hoppers at its bottom is constructed, as shown in Figs. 1, 2 and 3, with a plurality of narrow elongated sand outlets 13 preferably in parallel relation to each other disposed in the bottoms of longitudinal troughs made between the intermediate inverted V-shaped portions 14 which extend upwardly at the bottom of the hopper.

The several hoppers used are successively moved to three stations around the column 1. In one, a filling station, the hopper is filled with sand. In the next succeeding station, the one shown in Figs. 1 and 2, sand is forced from the hopper into the flask. At the third station the hopper is cleaned and made ready to be again filled with sand when it passes to the filling station after cleaning.

Near the upper end of the cylindrical column 1 a strong and heavy horizontal beam 15 is located and is provided with a divided collar 16 which passes around the cylinder 1 and is clamped thereagainst by clamping bolts 17 as shown. The beam 15 terminates in a horizontally located rectangular head 18 which is positioned directly above the station where a hopper filled with sand is stopped for the purpose of being operated upon to force the sand therefrom into a flask and against a match plate and patterns over which said flask is placed.

Four cylindrical guide rods 19 extend downwardly from the corners of the rectangular head 18 and serve to guide a compressed air chamber member 20 which is slidably mounted on the rods below the head 18, the rods passing through suitable guide sleeves or bosses, as shown in Fig. 1. Member 20 is hollow and has passages through it from its upper to its lower end. The open lower end of the member 20 is closed by a horizontal plate 22 permanently bolted to an outwardly extending flange 21 at the lower end of the member 20 by bolts 23. A plurality of spaced apart ports 24 are made vertically through the closure plate 22. These ports progressively widen downwardly from the upper to the lower side of the plate 24 as shown.

A horizontal shaft 25 is rotatably mounted on

and extends through the head 18. As fully disclosed in my prior filed application, Serial No. 755,688, the shaft 25 within the head 18 carries eccentrics over which depending links 26 are placed the lower ends of which pivotally connected to upwardly extending lugs or ears 27 cast integral with and extending upwardly from a top closure member 28 which is fitted in the upper open end of the chamber member 20, to completely close the same, and is permanently secured thereto. By turning the shaft 25 the entire compressed air chamber member 20 with the mechanism mounted thereon and carried within the same may be lifted to an upper position or lowered to a lower position, this being governed as to distance of movement by the throw of the eccentrics on which the links 26 are mounted. The guide rods 19 guide said chamber member 20 in its upward and downward movements.

Toward the lower portion of the chamber member 20 and within the same a plurality of vertical cylinders 30 are made in each of which a piston 31 is mounted for reciprocation. Each piston is connected to a piston rod 32 each of which at its lower portion passes through a guide sleeve 33. The rods 32 at their lower ends permanently connect with a large valve member 34 of rectangular form and which when in its lowermost position covers the upper ends of all of the ports 24 to prevent the passage of compressed air through said ports. The space in the lower portion of the member 20 between the lower sides of the pistons 31 and the upper side of the closure plate 22 constitutes a chamber 35 into which compressed air is carried by an inlet pipe 36.

The rods 42 extend upwardly above the pistons 31 through horizontal bars 37, a piston rod 32 extending through each end of a bar 47, and then pass upwardly through guide sleeves 38 which are connected to and extend in a downward direction from the member 28. A second shaft 39 with eccentrics 40 thereon extends through and is rotatably mounted on the member 20. Links 41, at their upper end portions around the eccentrics 40, extend downwardly therefrom and are pivotally connected at 42 to the bars 37. On rotating the shaft 39 from the position shown the members 37, rods 32, pistons 31 and the valve member 34 are elevated and ports 24 uncovered. The piston and cylinder constructions shown make the elevation of the heavy valve member 34 easier through a balancing of a portion of the pressure against the upper side of the valve member 34 by the same degree of pressure in an upward direction against the lower sides of the pistons, the compressed air pressure working equally upon both the pistons and the valve member. By turning the shaft 39 back after it has lifted the valve member 34 said member 34 may be returned to close the ports 24.

At the front end of the housing 4 an auxiliary housing 43 is provided, the upper end of which is closed by a top 44 which has downwardly and outwardly inclined surfaces 45 for the ready cleaning of sand away therefrom. Above the top 44 and supported thereby is a rectangular frame 46, there being openings 47 in the sides of the frame above the top 44 as shown. An auxiliary frame 48 is located within the frame 46 which at its upper edges, has a continuous outwardly extending horizontal flange 49 bearing upon the upper edges of frame 46 and forming a ledge support for a flask 50 used which is placed in an inverted position upon said ledge 48. When in the inverted position specified there are upwardly extending elongated projections 51 with passages 52 therethrough, the upper ends of which directly join with the narrow elongated outlet passages 13 in the bottom of the hopper 12.

Upon entering compressed air into the upper side of the hopper against the sand, the sand is forced downwardly through the openings 13 and passages 52 into the flask and against the match plate and over the patterns carried by the match plate which extends upwardly into the flask. The match plate 53 is a horizontal plate with suitable patterns at its upper side. It has integral downwardly extending sides and ends 54 which lie within the sides and ends of the auxiliary frame 48. A suitable packing 55 is disposed between the outer and inner sides of the parts 54 and the auxiliary frame 48. The match plate has a large number of vent openings 56 for the escape of such air as passes through the sand in the hopper and in the flask when the sand is forced by compressed air into the flask. The match plate is recessed adjacent the various vents and receives screen sections A in the recess, as shown in Fig. 4, thus preventing sand from passing through the vents 56.

The match plate rests upon a head 57, the upper sides of which are downwardly and outwardly inclined, the same as the top 44 and for the same purpose. Head 57 is carried at the upper ends of suitable cylindrical posts 58 which pass downwardly through and are guided in sleeve guides 58 formed through the top 44. Below the top 44 the posts are connected to horizontal heavy bars 60, the two posts at each end connected to one of said bars.

The bars 60 are adapted to be raised and lowered so as to raise and lower the head 57 and the match plate carried above said head. A cylinder 61 is mounted on horizontal trunnions 62 extending through the sides of the housing 4. Within the cylinder is a piston having a piston rod 63 which extends through an end of the cylinder and at its outer end is provided with a yoke 64 which has a pivotal connection at 65 with the upper end of a crank arm 66 mounted to rock a shaft 67 which is mounted horizontally in the lower portion of the auxiliary housing 43 (Fig. 2). Toggle link structures having upper links 68 and lower links 68a are disposed between the rock shaft 67 and a rod 69 extending between the bars 60. The toggle links are pivotally connected at their adjacent ends at 70. On movement of the piston rod 63 to the right (Fig. 2) the links are brought toward alinement, elevating the posts 58 and the head 57 in accordance with the extent of movement of the toggle link structures, thereby moving the match plate and patterns thereon upwardly.

A square threaded shaft 71 passes through an interiorly threaded sleeve 72 mounted in the front side of the auxiliary housing 43. Shaft 71 at its inner end has a head 73 located in the path of movement of a stop lug 74. A gear 75 is secured to the outer end of the shaft 71, meshing with which is a rack bar 76 mounted for longitudinal sliding movement in suitable brackets 77 secured at the front side of the auxiliary housing 43.

The chamber 35 is filled with compressed air at all times. With the valve member 34 closed this air cannot escape.

Starting with the match and pattern plate in the position shown in Fig. 2, a flask 50 is inverted and placed upon the ledge 49. The shaft 25 is

rotated or rocked to lift the member 20 a short distance. A hopper 12, filled with the required amount of sand, is then swung into position between the flask 50 and the lower side of the bottom plate 22. The hopper is stopped at the proper position through the engagement of the retaining latch or dog 9 in a recess of the ring 6. By lifting the member 20 and attached parts space is provided for the movement of the hopper into and between the flask and the lower side of the plate 22. The next operation is to turn the shaft 25 to lower the member 20 and bring the lower side of plate 22 against the outwardly extending flange at the open upper end of the hopper 12. Then by slightly further turning shaft 25 in the same direction a heavy pressure is exerted upon the hopper which will bring its lower or bottom side against the upper ends of the projections or necks 51 on the flask and make a sealed joint between the hopper and flask with the passages 13 and 52 in conjunction with each other. The pressure is sufficient to spring the arms 10 and 11 downwardly.

After this has been done shaft 39 is turned from the position shown in Fig. 1 to lift the valve member 34. The compressed air rushes through the ports 24 and against the upper side of the sand in the hopper 12 forcing the sand into the flask and around the patterns and over the match plate 53.

During this operation the position of the match plate and patterns is that shown in Fig. 2, that is, with the upper side of the match plate in a horizontal plane slightly below the plane of the upper side of the ledge 49. The upward limit of movement for the match plate is controlled by the position of the stop head 73 on the shaft 71 so that when compressed air is entered into the cylinder 61 to lift the match plate preparatory to the operation of making the mold, the head 73 is located inwardly a short distance, thereby limiting the extent of movement of the piston rod 63 and holding the match plate to an upper position such as shown in Fig. 2. After the compressed air has done its work upon the sand to force the same into the flask 50, valve 34 is closed by turning the shaft 39 in the proper direction. The mold is then completed by operating the rack 76 lengthwise to withdraw the shaft 71 and move the head 73 a short distance outward. Upon such withdrawal of the shaft the compressed air in the cylinder 61 moves the toggle link structures farther to the right, straightening the same into substantial alinement and lifting the match plate a short distance, or until its horizontal upper side is substantially in the plane of the upper sides of the flanges or ledge 49. There is thus produced a squeezing of the sand, which has been previously forced into the flask, into a smaller and more compact volume. It is the final step of completing the mold and compressing or packing the same to the required density.

After the operation of squeezing the sand the pattern is withdrawn from the mold. To accomplish this the compressed air is released from the cylinder 61 whereupon the piston rod 63 and the toggle link elevating structures move back to the position shown in Fig. 1. The match plate and patterns are lowered to the position shown in Fig. 1 leaving the flask with the completed mold therein resting upon the flanges 49 and underneath the hopper 12. To remove the flask the upper shaft 25 is rotated to elevate the body or member 20 thereby releasing the hopper from the flask and taking the strain off of the arms 10 and 11 so that the hopper elevates slightly above the flask. The hopper is then swung out of the way and the flask removed or the flask may be slid out from under the hopper. In any event the hopper is eventually swung out of the way to permit the placing of another hopper for the next succeeding mold.

For the next succeeding mold the bar 76 is moved back to move the head 73 inward to the position shown in Fig. 2 and compressed air again entered into the cylinder 61 to lift the match plate to the position shown in Fig. 2. Another flask is placed in inverted position to rest upon the ledge 49 and the operation may be repeated with a succeeding hopper of sand.

The flask used is of special construction having an integral cast bottom plate with slotted openings for the admission of sand from the hopper above into the mold. Either a drag or cope may be joined with a cooperating cope or drag to complete the mold. Molten iron is poured into the completed mold in accordance with the usual practice to fill the mold cavities. The patterns shown in Fig. 4 are such as may be used in the casting of cam shafts for internal combustion engines. The mechanism and the method followed is not, restricted, however, in any sense to the casting of any particular specific object.

The method of making molds described in conjunction with the description and operation of the machine illustrated is very practical and efficient and one by which very rapid quantity production of duplicate molds may be performed economically. The mechanism illustrated is for the purpose of making clear the method of mold forming which is my invention. It is, of course, evident that the method of producing molds disclosed in the present application may be made in many ways and by other mechanisms than that which has been described. The invention is therefore not to be restricted to the particular disclosure but is to be comprehensive of what is defined by the appended claim.

I claim:

The method of making a sand mold which consists, in providing a flask having an open side and a plurality of sand entrances at its opposite side, supporting said flask in an inverted position with its open side downwardly, horizontally positioning a match plate and pattern thereon below and adjacent to the open side of the inverted flask, forcing sand by fluid pressure through said openings in the flask to fill the flask with sand above said match plate and pattern, thereafter simultaneously moving the match plate and pattern upwardly a predetermined distance to squeeze the sand in the flask and then simultaneously drawing the match plate and pattern in a downward direction from the sand mold in said flask.

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