

Aug. 27, 1935.

E. F. OYSTER ET AL

2,012,478

MOLD MAKING MACHINE

Filed May 23, 1932

4 Sheets-Sheet 1

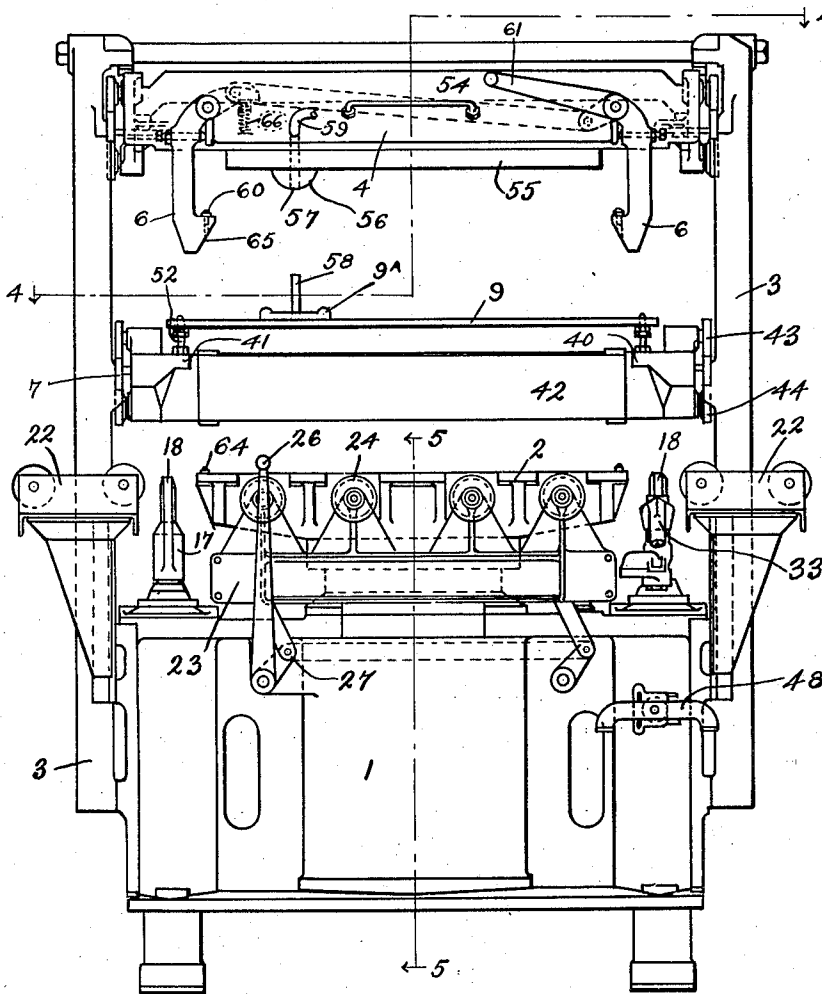


Fig. 1

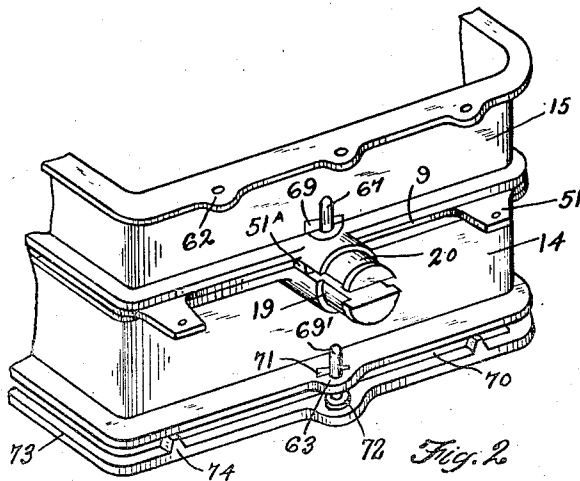


Fig. 2

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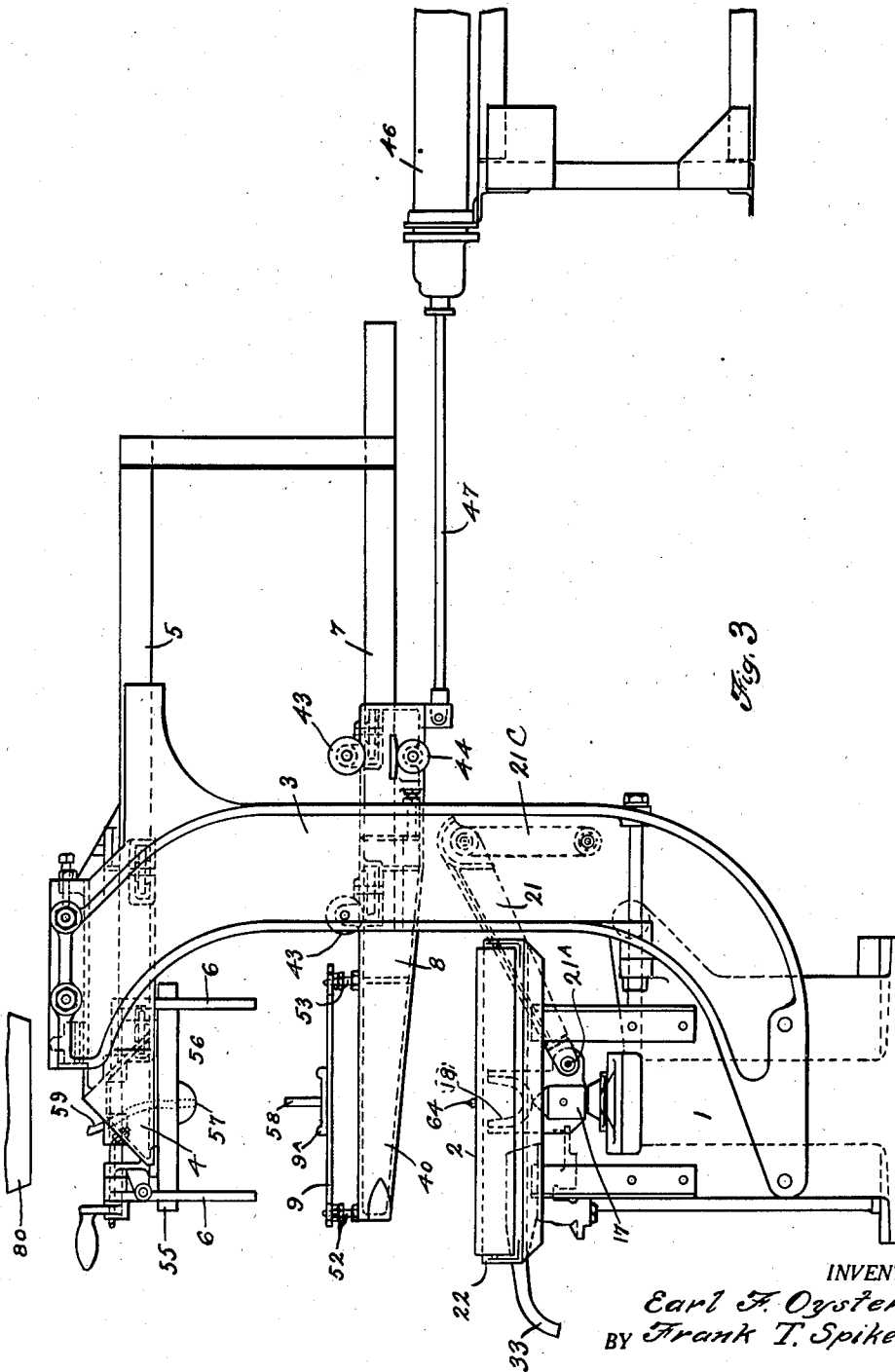


Fig. 3

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4 Sheets-Sheet 3

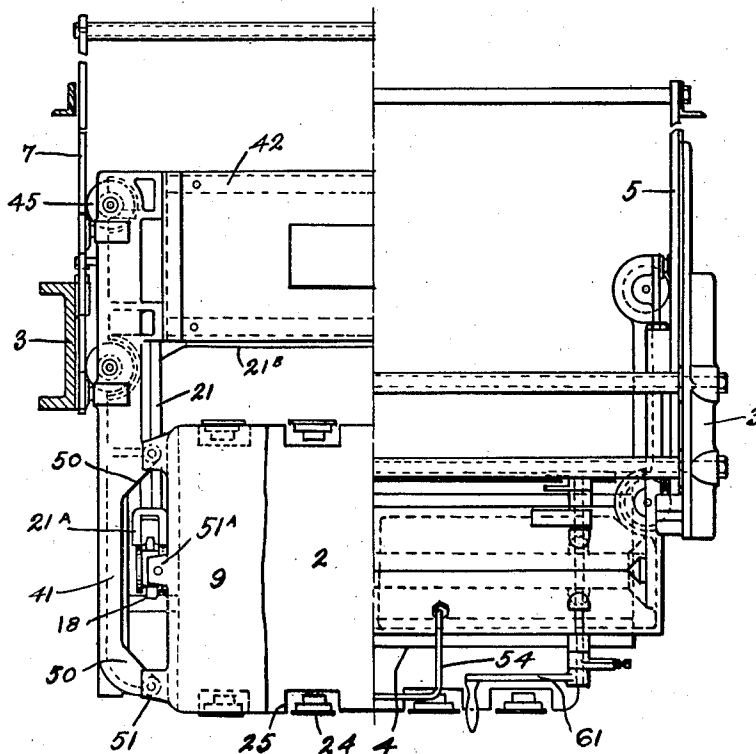


Fig. 4

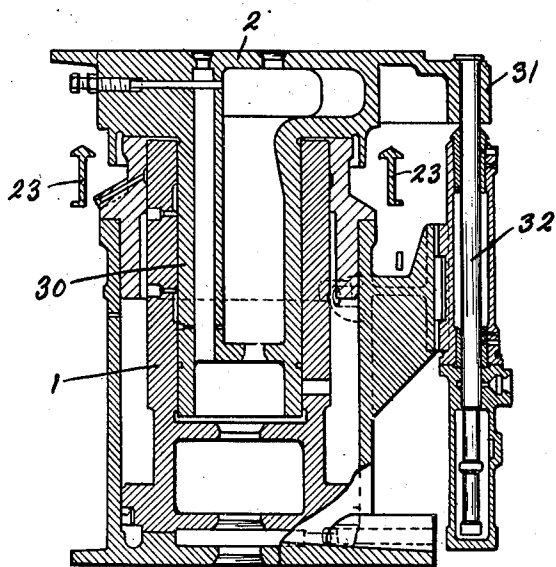


Fig. 5

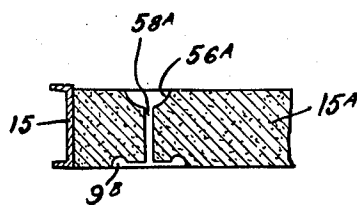


Fig. 6

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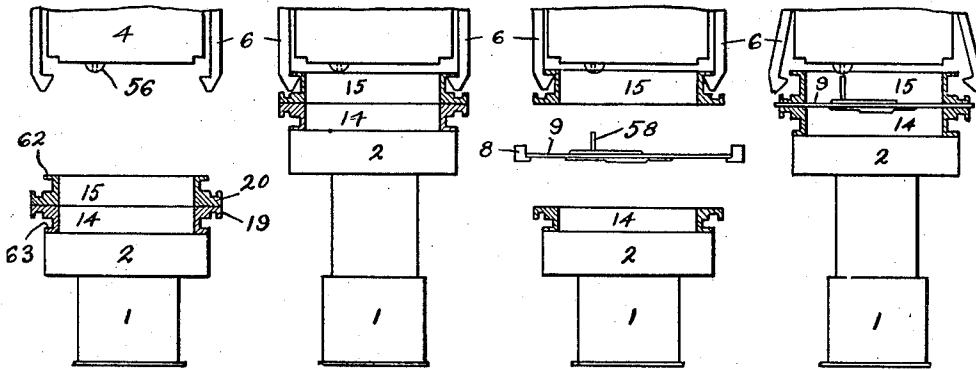


Fig. 7

Fig. 8

Fig. 9

Fig. 10

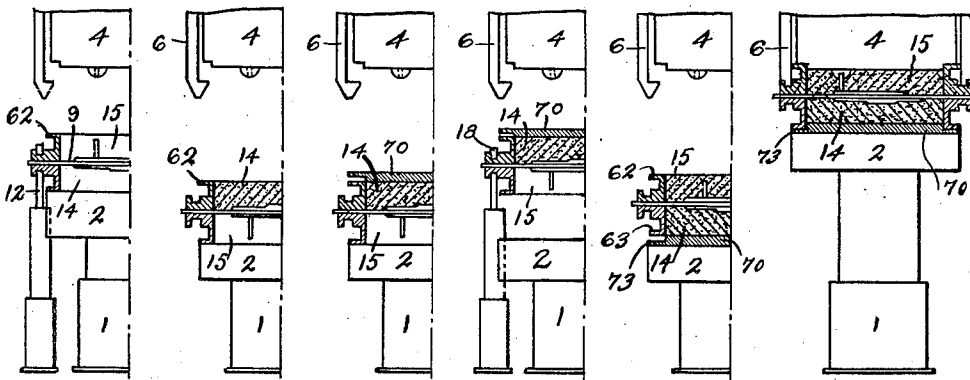


Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 16

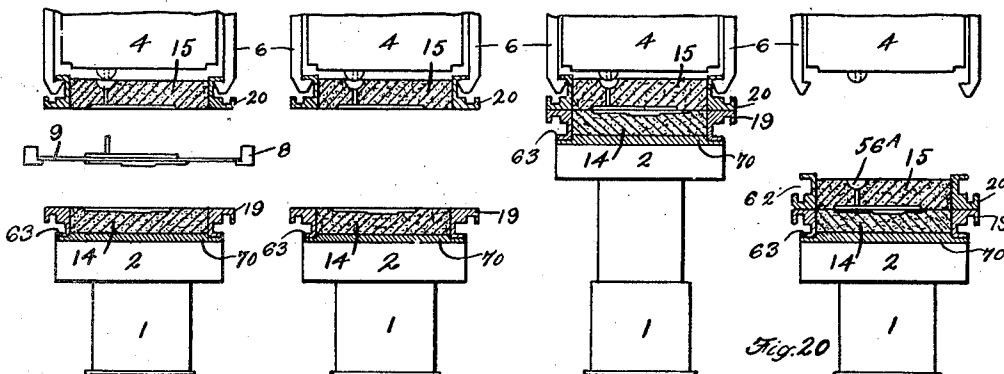


Fig. 17

Fig. 18

Fig. 19

Fig. 20

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## UNITED STATES PATENT OFFICE

2,012,478

## MOLD MAKING MACHINE

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Application May 23, 1932, Serial No. 612,946

7 Claims. (Cl. 22—25)

This invention relates to mold making machines and has for its purpose the provision of a machine which is semi-automatic in operation and particularly adapted for mechanical handling of large molds of a size beyond the manual capacity of one man.

The utility of this invention is not limited to molds for making stove plates, or other large shallow castings, but it is more particularly adapted for these than for deeper castings. The machine is, however, especially adapted for making molds of the sort in which both the cope and drag patterns are carried by a single match plate, and one purpose of the invention, in more detail, is to enable both cope and drag half-molds to be made at a single station on a single machine and eliminates the lifting of molds by the operator. It is, therefore, particularly adapted for making molds of such a size that ordinarily the cope mold and drag mold would have to be made on separate machines with split patterns. Another purpose of the invention is to enable the mold to be closed mechanically. Still another purpose of the invention is to provide means for automatically forming a pouring gate in the cope mold simultaneously with the squeeze of the cope mold. A further purpose of the invention is to provide means for the automatic mechanical handling of the pattern. To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain means and one mode of carrying out the invention, such disclosed means and mode illustrating, however, but one of various ways in which the principle of the invention may be used.

In the accompanying drawings Fig. 1 is a front elevation of a machine embodying the principles of our invention; Fig. 2 is an end view in perspective of a flask assembly; Fig. 3 is an elevation of the right side of the machine; Fig. 4 is a plan view of the machine on two planes indicated by the line 4—4 of Fig. 1, omitting the roll-over mechanism; Fig. 5 is a central vertical section of the table portion and base of our machine taken on the line 5—5 of Fig. 1, looking in the direction of the arrows; Fig. 6 is a detail in vertical section through a portion of a cope mold showing a pouring basin and gate; Figs. 7 to 20 inclusive are diagrammatic views, partly in front elevation and partly in vertical section, showing the cycle of operations of the machine.

The general assembly and operation of the machine are best understood by reference to Figs. 1 and 3. In its preferred embodiment this machine comprises a jolt and squeeze cylinder 1 of conventional type carrying a table 2 which differs from the usual type in certain particulars hereafter described. Supported by standards 3 behind either end of the table is a squeeze head 4 movable on a trackway 5 into and out of effective position in substantially the manner described in Patent No. 1,804,181 issued November 5, 1931, to Earl F. Oyster. This squeeze head also supports means 6 for engaging and holding a flask element. The standards also support another rearwardly extending trackway 7 at a lower level. A carrier 8 is movable thereon whereby a pattern plate 9, also known as a match plate, can be moved forward over the table 2 into a position between and vertically aligned with the flask elements 14 and 15, as shown in Figs. 3 and 9. This carrier 8 is also used to receive the pattern plate 9 when the mold is drawn and to move the plate back out of the way of succeeding operations. A further feature of the machine is a pair of vertical roll-over standards 17, upwardly movable by compressed air independently of the table 2, one at either end of the table, each of which carries at its top an open-topped bearing 18 to engage half trunnions 19 and 20 on the drag and cope molds respectively whereby the flask assembly may be rolled over. The lift of these bearings 18 is equalized by a rigid yoke consisting of two arms 21 pivoted at their free ends to the bearings 18 as at 21<sup>A</sup>, rigidly secured to a horizontal connecting rod 21<sup>B</sup> which in turn is pivotally supported in rear of the table by links 21<sup>C</sup>, all substantially as shown in detail in Figs. 5 and 6 of U. S. Patent No. 1,851,321, Molding machines, issued to Earl F. Oyster on March 29, 1932.

The table 2 is in the line of a roller conveyor system 22 whereby the flasks can be rolled onto the table for making the molds and rolled off the table with the completed molds therein. The roller conveyor system cooperates with the table by means of a vertically movable frame comprising front and rear plates 23 each of which supports a series of outwardly flanged wheels 24 which are spaced apart axially in alignment with the front and rear ends respectively of the rollers of the conveyor system 22. The top of the table 2 is cut away as at 25 to let the wheels 24 be moved up above the plane of the table top so that the wheel tread surfaces are on the horizontal level of the conveyor rollers. A hand lever 26 and a system of links 27, doubled on the rear

of the machine, raises and lowers the frame 23, the lowered position being shown in Fig. 1.

The squeeze and jolt mechanism per se may be of any usual form and while a preferred form of such mechanism is shown in Fig. 5 it will be understood that the details of this are not peculiar to nor essential to this invention, some of them being covered by other patents, and others being in accordance with the usual practice in the art. In Fig. 5 the squeeze cylinder is shown as containing a jolt cylinder 30, and a rearward projection 31 of the table 2 carries a valve rod 32 governing the squeeze movements. A valve 33, Fig. 1, controls the squeeze and draw operations. Coming now to the pattern plate carrier 8, as best shown in Figs. 3 and 4, this comprises a pair of arms 40 and 41 the length of which is about twice the width of the pattern plate 9. These arms are connected at the back by a cross member 42 and are supported at their rear ends by vertical wheels such as 43 and 44 running on the top and bottom, respectively, of the rails 7. Horizontal wheels such as 45 also bear against the sides of the rails 7. These rails 7 extend rearwardly to a distance such that the front end of the arms 40 and 41 can be drawn back entirely clear of the space above the table 2. The front and rear movement of the pattern plate carrier 8 is here shown as accomplished by an air cylinder 46, connected to the rear of the carriage by a piston rod 47. The valve 48, Fig. 1, actuates this air cylinder. The arms 40 and 41 include inwardly directed reinforced lugs such as 50 to support ears 51 on the corners of the match plate 9. There is also a middle ear 51<sup>A</sup> on each end of the plate 9, perforated to take a guide pin 67 when the flask and plate are assembled. These lugs carry upstanding studs 52 with suitable height adjusting means, such as nuts 53, to engage corresponding apertures in the ears 51 of the plate 9, as shown in Figs. 1 and 3.

The squeeze head 4 runs on a similar carriage on the horizontal track 5 at the top of the uprights 3 so that it can be moved forward into operative position or backward out of the way. The details of the squeeze head carriage are not in themselves a part of the invention and reference is made to Patent No. 1,804,181 for a detailed description of a suitable type of carriage for the purpose, such as used on the present machine. The squeeze head is moved manually by a handle 54, although power means could of course be employed. A pressure board 55, Fig. 1, is fitted to the bottom of the head, and a suitable number of bosses 56, one in the present instance, according to the size of the casting, are formed on the under side of this pressure board. A central vertical hole 57 through the boss is carried up through the board 55 to receive a vertical rod 58 which protrudes from the cope pattern 9<sup>A</sup>. An air hose is connected at 59 to the top of the hole 57. The purpose of the elements 56 to 59 inclusive is to make the pouring basin 56<sup>A</sup> and sprue 58<sup>A</sup> which lead to the cavity 9<sup>B</sup> in the cope mold 15<sup>A</sup>, Fig. 6. This operation is described further on.

Inturned hooks 6 depend from each corner of the head 4 each carrying an upwardly directed adjustable stud 60. These studs, when the hooks are in the vertical position of Fig. 1 which they naturally take under the influence of gravity and a spring 66, engage under lugs 62 on the flange of the cope flask 15, thereby supporting it as in Fig. 9. Each of the studs 60 fits into a corresponding hole in the flask flange. When the flask

is slightly raised off these studs and consequently away from the support of the hooks, the hooks may be moved out of position by means of a hand lever 61, to which all four are linked, thereby allowing the flask to move downward; see Figs. 9, 10 and 11. Suitable adjusting means for the hooks, both common and individual, are provided. The inner lower hook surfaces are inclined as at 65, so that when the mold is raised its flange will push the hooks out of the way. The hooks are then returned to supporting position by gravity and the spring 66.

The flask, Fig. 2, includes a few special features to enable it to be used with this machine, namely, the trunnions 19 and 20, the lugs 62 and 63, the pins 67 and 68 and the keys 69 and 71. The trunnions are segmental, each consisting of somewhat less than half a cylinder, the flat faces being in the plane of the top of the drag flask and of the bottom of the cope flask, respectively. The amount by which each trunnion is short of a complete half cylinder is half the thickness of the pattern plate 9. The result of this is that when the pattern plate 9 is in position between the halves of the flask, as in Figs. 2, 11 and 14, the arcs of the two opposed trunnion segments have a common center, so that the effect of the two trunnion halves when so assembled is that of a full cylinder from which there has been removed a horizontal longitudinal portion equal to the thickness of the pattern plate. Thus each trunnion rolls in its bearing as a true cylinder without jar. The two halves of the flask can be locked together, either with or without the pattern plate, by the pin 67 and key 69. The outer ears 62 of the cope flange are apertured to receive the studs 60 on the hooks 6, and the middle ear aperture positions the cope flask 15 on the studs 64 of the table 2 when the flask is inverted, as in Figs. 12 and 13. The hole in the ear 63 of the bottom flange of the drag flask 14 guides the flask on the studs 64 and also receives the pin 69' of the bottom board 70.

The bottom board 70 carries a pin 69' at each end in a boss 72 which is hollow beneath to fit over the corresponding stud 64 of the table 2 in the position of Fig. 15, for example. The bottom board is outwardly flanged at 73, as also shown in Fig. 15. In order to insure a correct fit of the board when the mold is squeezed, Fig. 16, low teeth 74 rise from the flange 73. These teeth, instead of the entire top face of the flange 73 bear up against the bottom flange of the cope flask. Thus sand on the flange 73 does not interfere with the fit of the bottom board.

The sequence of steps in the normal operation of the machine will now be described, reference being had particularly to Figs. 7 to 20 inclusive.

It is assumed that the machine has just completed making a mold and that the completed mold has been pushed off at the operator's left on the conveyor trackway. An empty mold stands on the conveyor trackway at the operator's right. The pattern carrier 8 is in its back position and the flanged wheels 24 are up with their tops in the plane of the tops of the conveyor rollers. Preferably sand is supplied from an overhead hopper 80, Fig. 3.

The operator now rolls the empty flask from his right to a position over the table 2, and lowers the wheels 24, allowing the flask to rest on the table, Fig. 7, positioned by engagement of the studs 64 with the holes in the ears 63. He next, Fig. 8, raises the table until the corner ears 62 of the cope flask 15 catch under the hooks 6, the

hooks having been automatically moved out by their inclined surfaces 65 as the flask went up and having dropped back so that the studs 60 registered with the holes in the ears. The table 2 is then lowered to the position of Fig. 9 and the cope flask remains suspended by the hooks while the drag flask goes down with the table to bottom position. The pattern carrier 8 is then brought forward, with the pattern plate 9 thereon, thus positioning the pattern plate in correct vertical alignment with the two halves of the flask, Fig. 9. To assemble the drag and cope with the pattern plate between them the table is again raised, Fig. 10, lifting the cope ears off the hooks. The assembly is locked together by the pins 67 and keys 69. The operator pulls the hand lever 61 moving the four looks 6 out of the way, and the table is lowered. Meanwhile the bearings 18 have been raised by the rods 17, so that the trunnions are caught in the bearings 18, Fig. 11. The flask is next inverted and then lowered onto the table 2 in inverted position, the drag flask 14 is filled with sand, jolt rammed and struck off all as indicated diagrammatically in Fig. 12. The bottom board is placed, Fig. 13, pinned and keyed. The flask is then raised on the roll-over bearings, see Fig. 14, rolled over to bring the cope uppermost, lowered onto the table 2, and the cope flask is filled and jolted, Fig. 15. The head 4 is run forward and the flask raised and squeezed, Fig. 16, which also forces up the bottom board 10, as usual.

The pattern is then drawn by lowering the table, leaving the cope suspended on the hooks 6, the keys 69 having been pulled. On the draw the pattern plate 9 is caught by the arms 40, 41 and the drag 14 goes down with the table 2, Fig. 17. The pattern plate carrier 8 is backed out of the way, Fig. 18, cores, if used, are set, the table is raised, Fig. 19, bringing the two halves of the mold together, and the assembled mold is lowered, Fig. 20, onto the wheels 24, which have meanwhile been raised, and is rolled to the left on the conveyor system 22.

The operation of the gate forming apparatus is as follows. The upper end of the rod 58 must be a little shorter than the height of the cope, to clear when inverted, Fig. 12. Consequently something must be done to open the top of the sprue 58A. It is also necessary to form a pouring basin in the top of the cope. If these operations were to be done manually it would be necessary to lower the cope flask from the position of Fig. 16, because in that position the cope is too high for a workman on the floor to reach the top, even if the squeeze head 4 was out of the way, which it is not. This trouble and loss of time is avoided, and the basin is formed and the gate put through, all automatically, by the boss 56 receiving the upper end of the rod 58 and at the same time displacing the mold sand to form the basin 56A, Fig. 6. When the mechanism is moved to the position of Fig. 17, any loose sand in the channel 58A and on top of the rod 58 falls down onto the pattern plate and so is left out of the mold. In order to dislodge all loose or partly loosened sand, which might fall inside the mold when the latter is closed, a jet of air is blown from the hose 59 through the passage 57 and channel 58A after the cope has been drawn, without taking time for an extra operation, and while the pattern plate 9 is still beneath the cope to catch falling sand.

It is evident from the foregoing that we have devised a molding machine, which, while not strictly automatic, may be termed semi-automatic inasmuch as it relieves the operator of all lifting, except the bottom board and that if patterns are

to be changed he has to lift the pattern plates. For the entire set of operations of molding so long as the same pattern is being used, he has no lifting whatever to do. The drawing and closing are entirely mechanical. At the same time the machine is of simple character. It does not involve any elaborate mechanism for rolling over and it uses only one jolt table for cope and drag. It is formed to cooperate fully with a roller conveyor system without needing any extra space and only a small amount of very simple additional mechanism, namely the wheels 24 and their movable supports.

Other modes of applying the principles of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:

1. In a molding machine adapted to form a two-part mold through all stages on a single machine, the combination of a squeeze head, a jolt squeeze table, and a pattern plate carrier, elements on said squeeze head and on said table adapted to hold and align one or more detachable flask elements; flask elements adapted for engagement with said table and/or said squeeze head; said flask elements comprising in detail a cope section, a drag section and a bottom board, said cope and drag being adapted selectively to hold a pattern plate between them and free of any other support; means on said flask elements for engagement with said holding and aligning elements, said means consisting of parts rigid and immovable upon said flask elements; said squeeze head and said table being thereby fitted to hold some or all of the various flask elements either assembled, or separated and vertically aligned; and said pattern plate carrier being adapted to support a pattern plate between the separated cope and drag flask elements.

2. In a molding machine adapted to form completely a two-part mold, the combination which comprises means for supporting and acting upon a flask assembly either assembled or in separated elements, and a flask assembly formed for coaction with said first means and comprising a cope flask, a drag flask, a bottom board, and at times a pattern plate; said first means including a jolt-squeeze table, a pattern plate carriage adapted to move said pattern plate into and out of the path of said table, and flask element suspension means attached to said squeeze head; positioning elements on said table, positioning elements on said carriage, and positioning elements on said suspension means, all of said positioning elements being adapted to align the several flask assembly elements when separated; the individual flask elements each including members for engaging some or all of the above recited positioning elements and members for supporting said pattern plate between cope and drag independently of all other supports, said engaging members being rigid with respect to their respective flask elements, the engaging means on the bottom board being engageable both with the positioning means on the table and with the positioning means on the drag flask; trunnion segments on the cope flask and on the drag flask, each of said segments being sufficiently less than 180° so that when the flasks are assembled with a pattern plate therebetween the arc of each segment forms part of the circumference of an in-

interrupted circle, rollover means operatively adjacent said table and engageable with the trunnions formed by said segments; and roller conveyor means selectively cooperable with said table but not movable therewith.

3. In a molding machine adapted to form a two-part mold through the forming and closing stages in a single machine, the combination which comprises a squeeze head, a squeeze table, a sectional flask and two distinct flask supporting means, one of said flask supporting means comprising trunnion cradles adapted selectively to support said flask above said squeeze table, said flask comprising cope and drag sections, and a substantially semi-cylindrical horizontal trunnion element at each end of each section, corresponding ones of said trunnion elements being adapted, when their respective flask elements are fitted together on opposite sides of a pattern plate, to form a cylinder, fitting one of said trunnion cradles.

4. In a molding machine in combination, a jolt-squeeze table, a squeeze head thereabove movable into and out of alignment therewith, a pattern plate holder thereabove movable into and out of alignment therewith, said holder being open across the front; sand-confining elements comprising a cope, a pattern plate, a drag, and a bottom board detachable from but cooperable with other elements of the machine; means on said table for positioning either said drag or said cope, means on said pattern plate holder for positioning said pattern plate, means on said squeeze head for holding said cope; interengaging means on said cope, said drag and said pattern plate for fastening cope and drag together either with or without the pattern plate therebetween; rollover trunnions on said flask comprising a part each on cope and drag; said flask either with or without pattern plate therein being adapted for support by said table, said pattern plate when in assembly being supported by and between said

cope and drag independently of all other supports, and a pair of standards clear of said table and adapted to engage said trunnions and adapted to be raised and lowered independently of said table.

5. In a molding machine, the combination of relatively movable pressing devices, and a parting and pattern plate, means whereby the pattern plate may be supported by the flask members, means whereby it may be independently supported and moved horizontally away from or between said flask members when the latter are separated, said means being also movable away from the flask members when said flask members are together, and means whereby the sand in the flask members may be jolted.

6. An automatic mold making machine comprising in combination a plurality of sets of flask holding means, one of said sets being adapted to engage end trunnions on a flask when said flask is assembled with a match plate therein, and to support said flask assembly by the lowermost member of said assembly, with the pattern plate and the other member of the assembly resting on said lowermost member.

7. A molding machine comprising in combination, flask members separable from one another and from the machine, slightly less than 180° of a trunnion on each end of each flask element, said part trunnions forming a broken circle when said match plate is engaged between the flask members, a match plate, means for moving said match plate into and out of alignment with said flask elements, said means comprising a carrier which in all positions clears the flask elements, a jolt squeeze table and a squeeze head adapted to cooperate with said flask elements, and independent flask lifting elements including a half round open-topped seat positioned and dimensioned to pick up or leave said trunnions.

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