Sept. 8, 1953 H. E. FELLOWS 2,651,087

MOLD MAKING MACHINE

Filed May 8, 1947 5 Sheets-Sheet 1

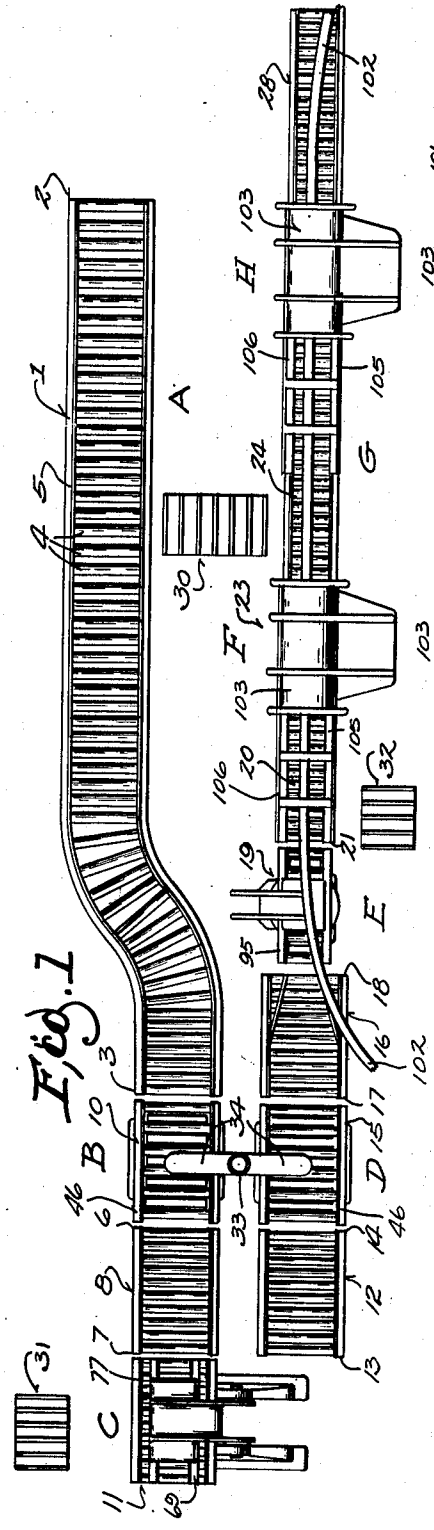

Fig. 1

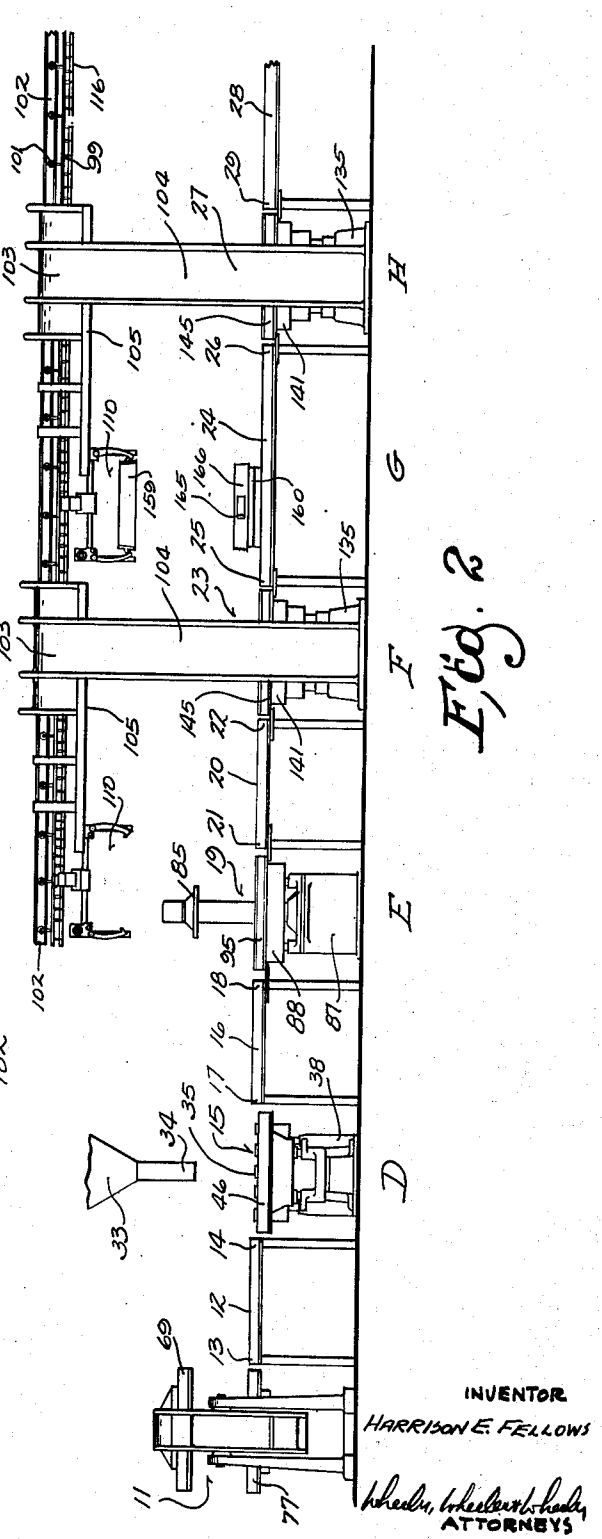

Fig. 2

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MOLD MAKING MACHINE

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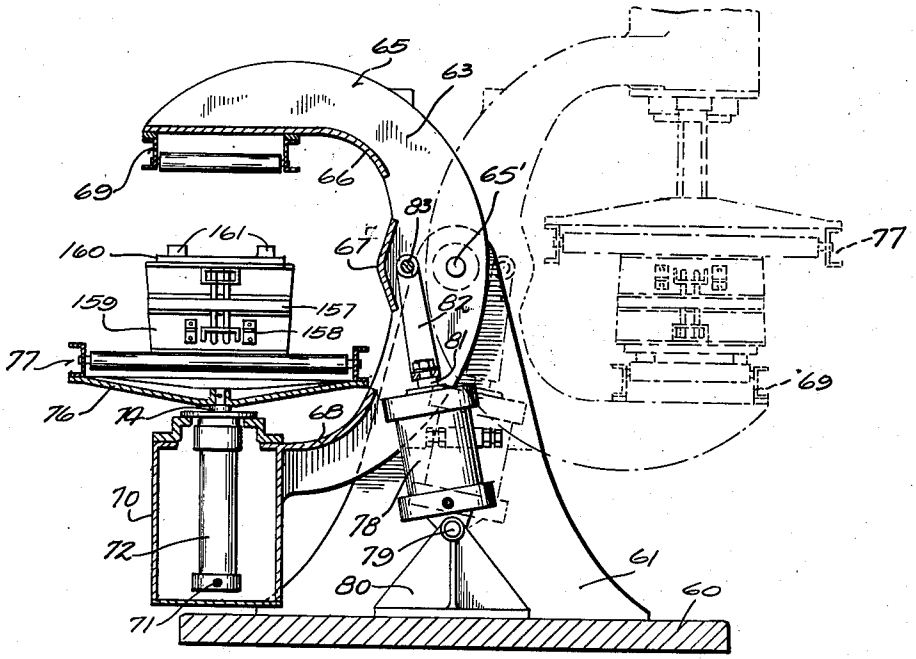

Fig. 3

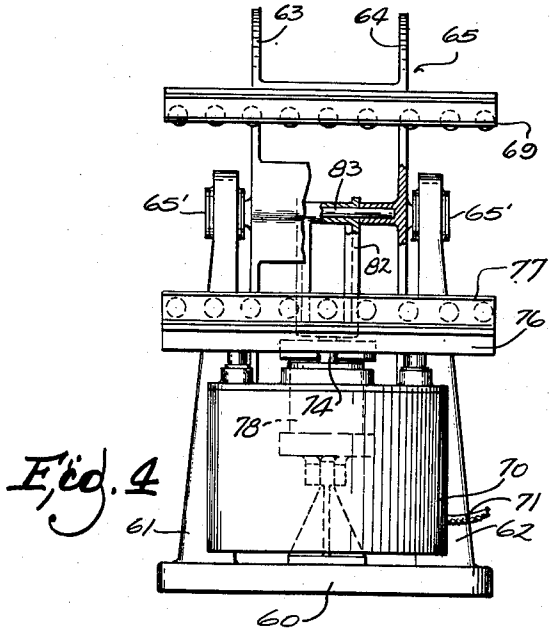

Fig. 4

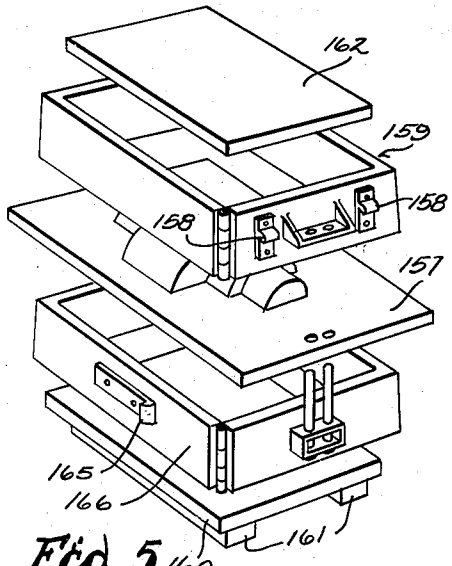

Fig. 5

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MOLD MAKING MACHINE

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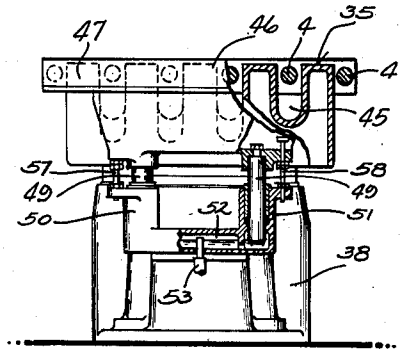

Fig. 6

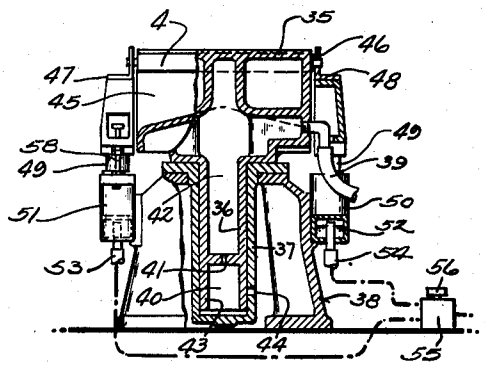

Fig. 7

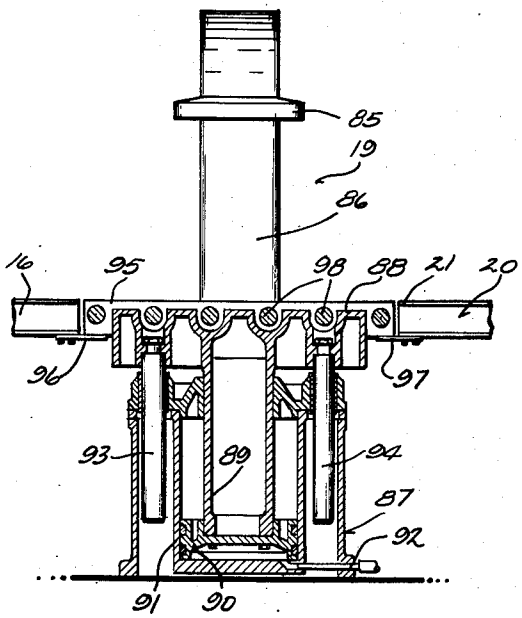

Fig. 8

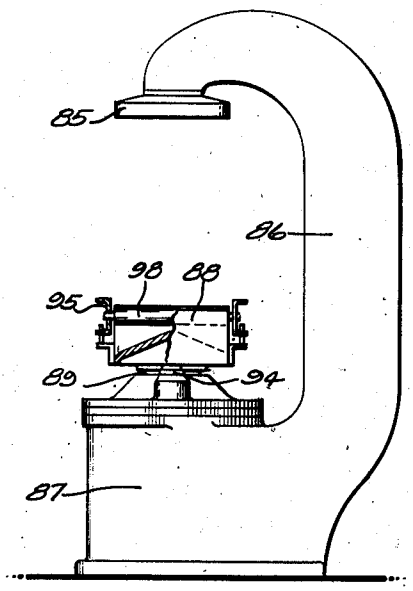

Fig. 9

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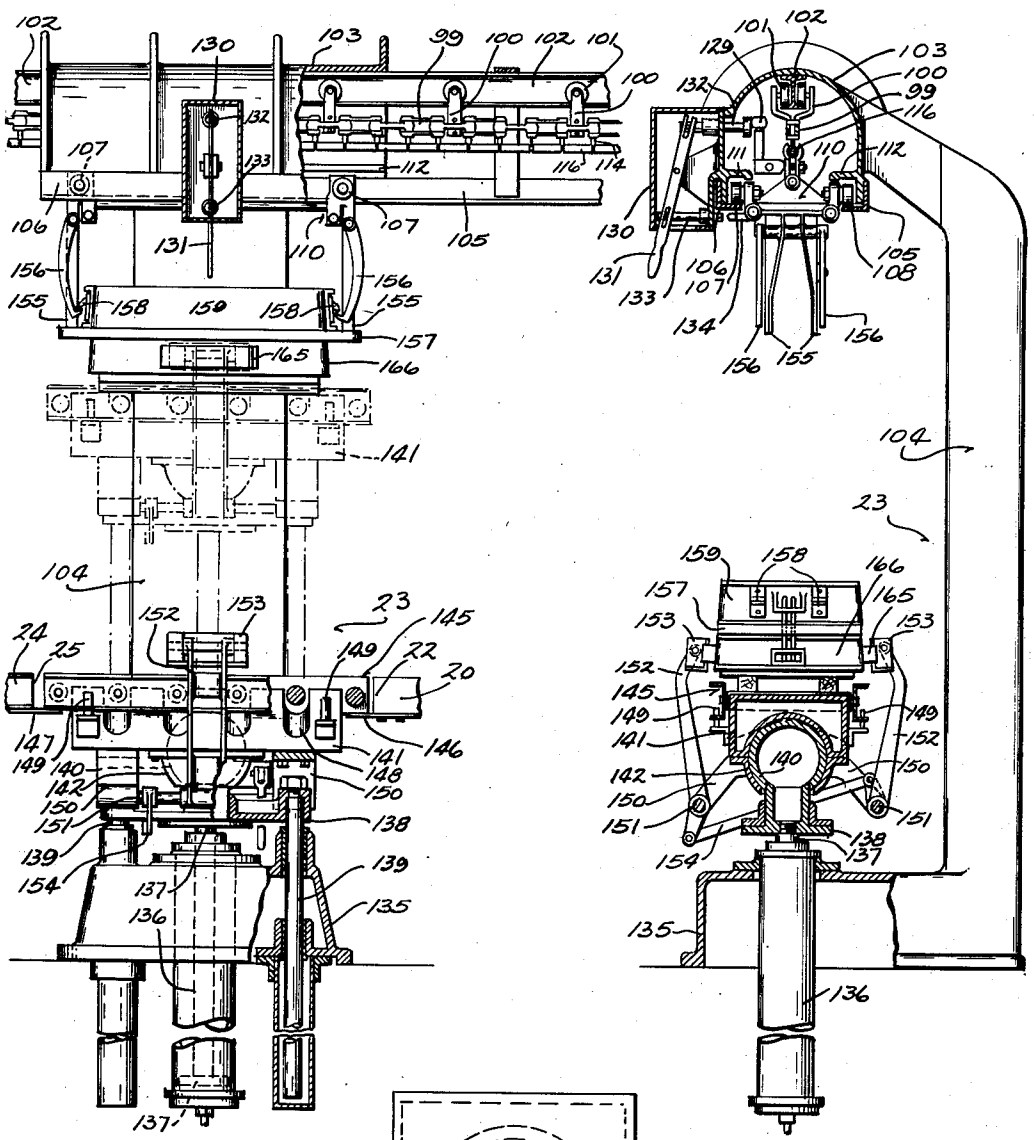

Fig. 10

Fig. 11

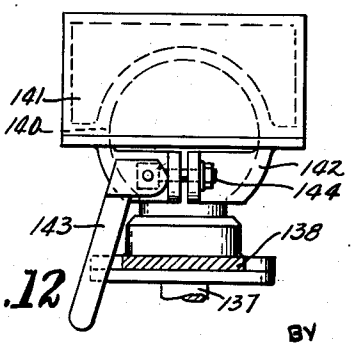

Fig. 12

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MOLD MAKING MACHINE

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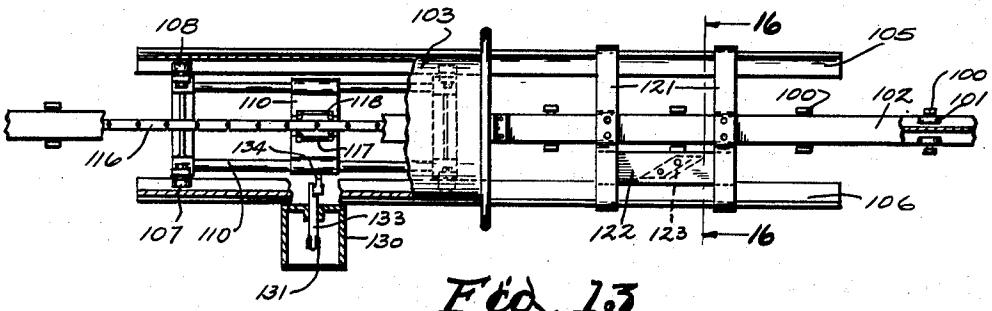

Fig. 13

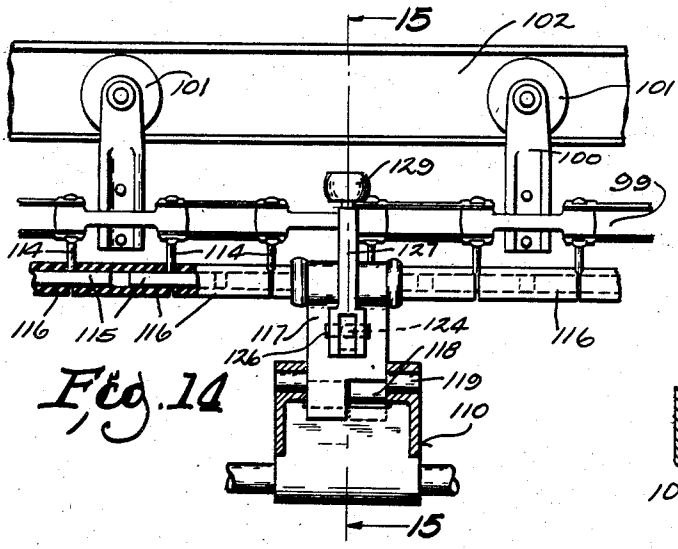

Fig. 14

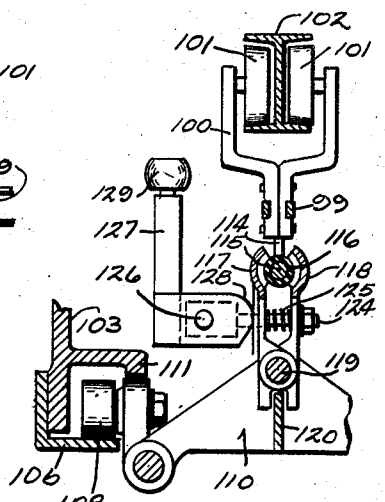

Fig. 15

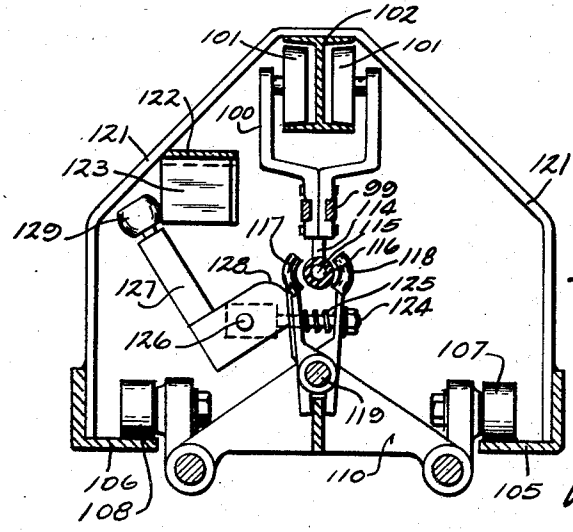

Fig. 16

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Patented Sept. 8, 1953

2,651,087

UNITED STATES PATENT OFFICE

2,651,087

MOLD MAKING MACHINE

Harrison E. Fellows, Wauwatosa, Wis.

Application May 8, 1947, Serial No. 746,835

12 Claims. (Cl. 22—31)

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This invention relates to a mold making machine for foundries.

It is a primary object of the invention to expedite the making of molds for match plate patterns by successive operations wherein the work of several men is mechanically coordinated so that each man, however unskilled, may perform a single operation with little or no physical exertion and with a minimum of handling of the cope, drag, and pattern.

It is a further object of the invention to permit a variety of molds of differing sizes or character to be run simultaneously, and to enable the use of existing pattern and flask equipment with minor changes.

Other objects will appear more particularly in the following disclosure of my invention.

In the accompaying drawings:

Fig. 1 is a plan view of apparatus embodying the invention.

Fig. 2 is a view in side elevation of the apparatus shown in Fig. 1.

Fig. 3 is an enlarged detail view partially in section showing a flask inverting apparatus which is a part of the device shown in Fig. 1.

Fig. 4 is a view partially in front elevation and partially in section showing the apparatus of Fig. 3.

Fig. 5 is a view in perspective showing the disassociated parts of a flask for use in my improved machine.

Fig. 6 is a view partially in side elevation and partially in longitudinal section showing a jolt machine which is a part of the apparatus shown in Fig. 1.

Fig. 7 is a view partially in transverse section and partially in elevation through the jolt machine shown in Fig. 6.

Fig. 8 is a view in longitudinal section through a squeeze machine which is a part of the apparatus shown in Fig. 1.

Fig. 9 is a view partially in elevation and partially in transverse section through the squeeze machine shown in Fig. 8.

Fig. 10 is a view partially in side elevation and partially in longitudinal section showing a draw machine which is a part of the apparatus shown in Fig. 1.

Fig. 11 is a view principally in transverse section and partially in elevation showing the device of Fig. 10.

Fig. 12 is an enlarged fragmentary detail view showing a table clamp which is a part of the machine shown in Figs. 10 and 11.

Fig. 13 is a view partially in plan and partially

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in horizontal section through the apparatus of Fig. 10 and Fig. 11.

Fig. 14 is an enlarged fragmentary detail view in longitudinal section through a portion of the apparatus shown in Fig. 13.

Fig. 15 is a fragmentary detail view on an enlarged scale taken in transverse section on the line 15—15 of Fig. 14.

Fig. 16 is a detail view taken in section on the line 16—16 of Fig. 13 and showing the parts on an enlarged scale.

The conveyor section 1 is continuous from its starting end 2 to the point 3 where it is interrupted. The conveyor is of a standard type on which work is manually propelled over the rollers 4 which have fixed mountings in a suitable frame at 5.

Beginning at 6 and ending at 7, there is another like, but shorter conveyor section 8. Betwen the terminal end 3 of conveyor section 1 in the beginning 6 of conveyor section 8, I provide at station B a jolt machine 10 of construction hereinafter to be described. Beyond the terminal end 7 of conveyor section 8, I provide an inverting machine 11 of construction hereinafter to be described.

The returning side of the conveyor comprises a short section 12 which may be identical with section 8, having a receiving end 13 and a delivery end 14. At station D there is another jolt machine at 15 which may be identical with that shown at 10. Beyond the jolt machine on the return side of the conveyor, there is a section 16 having a receiving end 17 and delivery end 18. At station E, adjacent the delivery end of conveyor section 16, there is a squeeze machine 19. Beyond the squeeze machine, the conveyor continues with section 20 having a receiving end 21 and delivery end 22 leading to a draw machine 23 at station F. Beyond the draw machine, there is a conveyor section 24 having a receiving end 25 and a delivery end 26 leading to a close machine 27. Beyond the close machine, the conveyor section 28 having a receiving end 29 continues to any desired length.

There are suitable racks disposed at convenient points and including a pattern rack 30, a bottom board storage rack at 31 and a squeeze board rack 32. There is also a mold sand hopper 33 with a delivery spout 34 serving stations B and D.

For details of the vibrating or jolt machines shown at 10 and 15 at stations B and D (these two machines being identical), reference is made to Figs. 6 and 7. The jolt table 35 is supported

on piston 36 which operates in cylinder 37 disposed within the machine base 38. The interiors of the table and piston are hollow and arranged to be supplied with air under pressure through the air hose 39. There is a cavity at 40 in the end of the piston communicating through a duct 41 with the hollow interior chamber 42 in which the air is stored. The skirt portion 43 which defines the cavity 40 in the end of the piston serves as a valve which, in the course of piston reciprocation, clears an air outlet port 44 in the cylinder 37. The air passing the duct 41 to cavity 40 raises the piston and the table 35 until the air in cavity 40 can escape through port 44. Since the duct 41 is of a diameter insufficient for the immediate replacement of such air, the escape of the air confined beneath the piston and the head of the cylinder allows the entire table and piston assembly to drop until air pressure again builds up in cavity 40 to a value sufficient to elevate the table. The resulting vibration occurs, in accordance with standard practice, at a rate of perhaps 180 to 200 vibrations per minute.

A novel feature of the present machine consists in the provision of deep transverse channels at 45 in the table 35. In these channels are disposed the rolls 4 of a short conveyor section 46. The side bars 47, 48, upon which the rolls 4 are mounted in this section are each carried on two pistons 49. The cylinders 50, 51 at each side of the machine have their head portions communicating with a hydraulic pressure chamber 52 in which there is hydraulic liquid and to which the operator may admit, above the surface of such liquid, air under pressure from hoses 53, 54, subject to the control of a common valve 55 which may be operated by a foot pedal 56 or otherwise.

The side frames 47, 48 are guided and also restrained as to their limit of vertical movement by the headed pins 57, 58 shown in Fig. 6 and Fig. 7.

The range of vertical movement of conveyor section 46 is such that, when elevated, it is substantially flush with the terminal end 3 of conveyor section 1, at which time its rollers 4 are above the level of the vibratory table 35. When the pressure on foot pedal 56 is released to vent the air pressure on the hydraulic chamber 52 through the valve 55, the conveyor section drops its rollers 4 into the channels 45 of the table, thereby lowering on to the vibratory table any part which has arrived on the conveyor section to a point above the table.

The flask inverting machine 11 is shown in detail in Figs. 3 and 4. There is a base 60 supporting base pedestals 61, 62 to which the side members 63, 64 of the oscillatory sub-frame 65 are individually pivoted at 65'. The sub-frame sides provide open jaws. The sides are cross connected by webs at 66, 67 and 68. Upon the jaw portions spanned by web 66 are mounted the side rails and rollers of a conveyor section 69. On the opposing jaw is mounted a chamber 70 which houses the pressure cylinder 72 having an air connection at 71. The cylinder 72 has a piston 74 supporting the movable table 76, which carries the side rails and rollers of conveyor section 77.

Mounted between the columns 61, 62 is a cylinder 78 pivoted at 79 to a support 80. Connected with the piston rod 81 operable in such cylinder is a yoke 82 pivotally connected on the bar 83 which spans the space between suitable bosses and the subframe sides 63, 64 as shown in Fig. 4. Pressure quickly applied on cylinder 78, and quickly released, will cause the entire sub-frame 65 to invert itself from either of its two positions to the other, as indicated in dotted or full lines in Fig. 3. Pressure applied to the pressure cylinder 72 will raise the table 76 and conveyor 77 to engage the flask or mold on conveyor section 77 with conveyor section 69, whereby the cope and drag are held together during inversion between the full line position and the dotted line position of Fig. 3.

For details of the squeeze machine 19, reference is made to Figs. 8 and 9. In the particular device illustrated, the squeeze machine comprises a clamp having a fixed upper jaw 85 supported by an arm 86 rising from base 87. The movable jaw comprises a table 88 supported by a piston 89 having a piston head 90 operating in a cylinder 91 within the base, the head portion of the cylinder being provided with a fluid supply connection 92. The guide bars 93, 94 connected with the table and reciprocable in suitable bearings in the base 87 guide the table during its vertical movement.

Spanning the table is a conveyor section 95 which normally rests on brackets 96, 97 carried by the stationary conveyor section 16, 20. The table 88 is transversely channeled to receive the rollers 98 of conveyor section 95, the table normally being below the level of work supported on such rollers. When pressure is applied in cylinder 91 to raise the piston which supports the table, there is a certain amount of lost motion between the table and the conveyor section 95 until the rising table engages the rollers. At about the same time, or prior thereto, the top surface of the table will rise above the level of the rollers to take from the rollers the weight of a workpiece mounted thereon. The continued rise of the table will lift the entire conveyor section 95 from its supporting brackets 96, 97 and the rise will continue until the work is squeezed against the stationary pressure jaw 85.

For disclosure of the draw and close machines shown at F and H, reference is made to Figs. 1 and 2 and Figs. 10 to 16. An endless conveyor chain 99 (Fig. 10 and Fig. 11) is provided with arms 100 which support the chain from rollers 101 operating on an endless conveyor track 102, portions of which pass through the draw and close apparatus 23, 27 at stations F and H. These pieces of apparatus are very similar and at each the track 102 passes through the top of a housing 103 carried by a column 104. The housing 103 takes the form of an inverted channel provided along its lower margin with guide rails 105, 106 for the wheels 107, 108 of a cope carriage 110. Flanges 111, 112 connected with the sides of the housing 103 above the rails 105, 106, overhang the carriage 110 to prevent it from being displaced upwardly.

The pintles which connect the links of the conveyor chain 99 are extended downwardly to provide hangers 114 (see Fig. 14). Each of these is T-shaped, being provided with a cylindrical head 115, the several heads being connected with short lengths of rubber hose or rubber tubing 116 as also shown in Fig. 14. Together the rubber tubes 116 constitute a virtually continuous driving clutch element and support with which may be engaged the jaws 117, 118 which are pivoted on pintle 119 of carriage 110 and extend beyond the pintle to engage a web 120 which serves to keep the jaws approximately centered.

Where the rails 105, 106 project beyond the casing 103 (Fig. 13), they are supported by brackets 121 from the conveyor track 102 (see also Figs. 10 and 16). As viewed in Fig. 13, the conveyor chain is moving from right to left. Spanning the

space between two consecutive brackets 121 is a plate 122 upon which I mount a clutch disengaging cam 123. Spanning the space between the pivoted jaws 117, 118 is a link 124 of adjustable length encircled, between the jaws, by a compression spring 125 tending to open the jaws. Pivotally mounted on the link bolt 124 by pintle 106 is a bell crank lever 127 having a cam surface 128 normally engaged with the jaw 117 as shown in Fig. 15. At its upwardly extending free end the bell crank lever 127 has a cam follower roller 129 which, when engaged by the stationary cam 123 as shown in Fig. 16, tilts the bell crank lever to so manipulate the cam surface 128 thereof as to permit the clamp jaws 117, 118 to separate under compression of spring 125 thereby releasing the carriage from the propulsive action of the conveyor.

Mounted on the side of the housing 103 is the control case 130 shown in Figs. 10 and 11. Pivotally mounted therein is the control lever 131 which operates rods 132 and 133 slidably guided to move through the wall of the housing 103.

When the handle end of lever 131 is pushed inwardly from the position shown in Fig. 11, the end of plunger 133 enters the housing 103 in the path of a stop member 134 carried by carriage 110, thereby accurately to define the position at which the carriage will come to rest. When the operations at this station have been completed, the lever 131 may be moved to position shown in Fig. 11, whereupon the stop plunger 133 is retracted and the plunger 132 is advanced into contact with the cam follower roller 129 thereby manipulating the bell crank lever 127 to reengage the clutch jaws 117, 118 with the movable supporting and clutching tubes 116 suspended beneath the conveyor, thereby reengaging the carriage with the conveyor for movement out of housing 103.

At all points save those where the tracks 105 are provided, the carriage will be suspended on the flexible supporting and propelling clutch tubes 116 hanging beneath the conveyor. As the tracks 105, 106 are encountered by the rollers 108 of the carriage, the weight of the carriage is transferred from the conveyor to the tracks, but the propulsion of the carriage by the conveyor continues until the clutch jaws are opened as shown in Fig. 16. There will be a considerable number of such carriages moving with the endless conveyor circuitously about the conveyor track 102, but they will be spaced sufficiently far apart so that the operator will finish using each and start it on its way before another arrives at the station. The usual motor switch (not shown) may also be used to stop the conveyor if, for any reason, it brings a carriage to one of the stations before the operator is through with the preceding carriage at that station.

Mounted directly beneath each housing 103 is a base 135 in which is disposed a cylinder 136 having a piston or plunger 137. The crosshead 138 on the upper end of the plunger is connected with guide bars 139 having suitable bearings for vertical reciprocation in guidance of the plunger. Carried by the plunger centrally of the crosshead is a spherical bearing element 140 and universally pivotal on the bearing element 140 is a table 141 having a concave recess complementary to the bearing element and embracing 180 degrees thereof. Connected with the table below the diametrical plane of such recess is a split segmental clamp 142 connected with the table and adapted to be tightened by a cam lever 143 and link 144.

By this means, the table may be held in any position of universal adjustment which it assumes on the spherical bearing element 140.

Spanning the table is a conveyor section 145 resting at its ends on brackets 146, 147 carried respectively by the end 22 of conveyor section 20 and the end 25 of conveyor section 24. As in the case of similar conveyor sections previously described, this conveyor section comprises side rails and rollers. The rollers normally project above table level, but are receivable into channels 148 when the table is raised. Pins 149 on the sides of the table (Fig. 10) guide the conveyor channels for the limited lost motion possible between the table and the conveyor. When the plunger 137 rises due to the introduction of fluid under pressure in cylinder 136, the upward movement of the table picks up the work from the several rollers of the conveyor section 145 and the continued upward movement of the table carries the conveyor section with it away from the supporting brackets 146, 147. The lowering movement of the table first deposits conveyor section 145 on the said brackets and the continued lowering movement of the table withdraws it from support of the work, the load thereof being thereby restored to the conveyor rollers.

It is important to the use of the drawing and closing machines that the molds or flasks be centered on the conveyor. For this purpose, the conveyor table is provided with brackets 150 supporting the oscillatory bars 151 which carry the centering arms 152. These arms have work engaging pads 153 at their ends and are cross connected by link 154. When the operator pushes inwardly on the free end of the arm 152 which is nearest to him, he correspondingly moves the other arm inwardly, whereby the work is positively centered.

Depending from each end of the carriage 110 are stops 155 (Figs. 10 and 11) and the pivoted hooks 156. The stops are engageable with the projecting ends of the pattern plate 157 (Fig. 10) while the hooks at the ends of the pivoted arms 156 are engageable beneath the complementary flanges 158 at the ends of the cope 159.

The operation of the equipment is as follows:

An operator at station A takes from the receiving end of conveyor 2 a flask which has been placed thereon by an operator at station H as will hereinafter be described. The operator at station A separates the cope and drag and gets the correct pattern from the pattern rack 30, cleans the pattern and assembles it between the cope and drag with the drag side of the flask uppermost. He then pushes the assembled flask down the conveyor to the operator at station B.

The operator at station B elevates conveyor section 46 to the level of conveyor section 1 to receive the flask assembly. He then pulls the assembly into position on conveyor section 46 above the jolt table 35. Thereupon he lowers the conveyor section 46 to deposit the flask assembly on the table and he then fills the drag with sand and operates the jolt cylinder sufficiently to obtain correct mold density. He strikes off surplus sand flush with the drag flask, elevates the roller conveyor section 46 flush with stationary conveyor section 8, pushes the flask assembly toward station C and pulls in the next flask assembly for the operation performed by him.

The operator at station C gets the correct bottom board 160 from the rack at 31. As shown

in Fig. 5 and Fig. 3, the bottom board is provided with bars 161 which will ultimately lie therebeneath but which are placed uppermost at this point. Rolling the flask assembly on to conveyor section 77 of the roll-over machine shown in Fig. 3, the operator applies pressure to the cylinder 72 to elevate the flask until the bars 161 of the bottom board contact the rollers of conveyor section 69. The cope and drag are now clamped together on the pattern plate and the bottom board is clamped against the sand which fills the drag. Thereupon a charge of compressed fluid is delivered to the cylinder 78 which inverts the roll-over jaws, leaving the parts in the position shown in dotted lines in Fig. 3 whereby conveyor section 69 is registered with the receiving end 13 of conveyor section 12 leading to the second jolt machine. The clamping pressure on cylinder 72 is now released and the operator pushes the assembly toward station D. The second jolt machine 15 at this station can be omitted if it is not desired to vibrate the sand in the cope, which is now uppermost. At station D, the cope is filled with sand, and if a jolt machine is provided at this station, the sand in the cope may be vibrated by the same procedure as that followed at station B. If loose sprues are used, they will probably be positioned by the operator at station D before he fills the cope with sand. The finished mold is then pushed by this operator toward station E.

The operator at station E gets the correct squeeze board 152 from an appropriate rack such as that shown at 32, this board having smaller overall dimensions than the cope. He places this board upon the sand in the cope and pushes the assembly into the squeeze machine shown in Figs. 8 and 9. The application of pressure in the head of cylinder 91 acts on piston 89 to raise the table 88 and thereby to elevate the entire assembly until the squeeze board contacts the fixed jaw 85 thereby imposing great pressure on the sand. Relief of pressure lowers the table and the assembly until the conveyor section 95 again rests on brackets 96, 97 and picks the loaded assembly from the moving jaw table 88. The operator then returns the squeeze board to the rack, cuts the sprue hole or removes loose sprue, if necessary, and pushes the assembly toward station F.

The operator in charge of the draw machine at station F pulls the assembly over the conveyor section 145 until the stops 165 on the sides of the drag flask 166 contact the end of the shoe 153 of the centering mechanism. Centering mechanism is then operated to center the assembly side which is on the conveyor. If a flask vibrating device is used, the vibrator hose is attached at this point (not shown).

Meantime a carriage 110 has been propelled by the conveyor 99 to a point where its rollers 107, 108 have been picked up on the rails 105, 106, whereupon it has been detached automatically from the conveyor by the stationary cam 123 acting on cam follower 129 as above described. The operator now pulls this carriage into position against the stop plunger 133, which locates the carriage directly above the centered mold. The table 141 is now raised to take the load of the mold off of conveyor section 145 and to elevate the mold until the ears 158 of the cope displace the hooks 156 and are engaged over the hooks. At this point, the pattern plate is squared up at right angles to the motion of the hoist by engagement with the stops 155. The upper surfaces of the carriage will be forced against the finished surfaces of flanges 111 and 112 to receive the thrust. Any uneveness of the bottom board 160 is compensated for by the tilting of the table on its ball and socket mounting. The ball and socket joint is now locked and the hoist is lowered by releasing the pressure from cylinder 136 to permit the table to recede. Since the hooks 156 of the carriage are firmly engaged beneath the ears 158 of the cope, the cope flask will be supported and the pattern and drag will be drawn from the part of the mold which is left hanging in the cope flask on the carriage. As soon as it is free, the operator manipulates lever 131, pulling it outwardly to withdraw the stop plunger 133 and to force in the clutch plunger 132 whereby the carriage clutch is reengaged with the conveyor moving toward the close machine. By hand, the operator then grasps the pattern plate and supports it, permitting the drag mold to draw from the pattern plate. He then detaches the vibrator hose, restores the pattern to the pattern rack 30 and pushes the drag mold across the conveyor on to conveyor section 24, where an operator at station G sets the core.

Meantime the cope has traveled overhead to the close machine 27 at station H until the carriage is automatically de-clutched from the conveyor on the track extension rails 105, 106 as above described. The operator at station H draws the cored drag mold into the close machine and centers it exactly as it was centered in the draw machine. He then pulls in and centers the carriage directly over the drag, raises the table until the cope has closed over the drag and finally manually releases the hooks from the cope and lowers the table with the completed mold. While the table is receding, he pulls the lever which releases the carrier stop and re-clutches the empty carriage to the conveyor. In the circuitous movement of the conveyor, the carriage is ultimately restored to the draw machine where the operation is repeated. The conveyor is the mechanical pace setter for the entire unit, as a predetermined number of carriages pass through the draw and close machines each hour unless, in an emergency, the conveyor movement is arrested as above mentioned.

With the completed mold resting on the bottom board on the discharge conveyor section 28, the operator at station H now strips the flask from the mold and sets it on the return conveyor 1 within reach of the operator at station A for a repetition of the sequence of operations.

In the draw and close machines, the adjustment of the parts automatically effected by the various stops and tilting of the table assures a perfect draw and a perfect close irrespective of the skill of the operator, who has but to manipulate a few easily understandable mechanisms to get substantially perfect results.

It is also true of the remainder of the apparatus that each operator performs only the simplest of operations, no particular skill being required, and no physical exertion beyond the lifting of the empty flasks and patterns and boards.

At the same time, the apparatus is highly adaptable. Molds for quite dissimilar objects may be run through the machine in any sequence and the machine parts will handle them all in the same manner.

I have, in effect, provided two conveyor flights which are side by side. The first flight comprises conveyor sections 1, 46, 8 and 77 (section

46 being on the jolt machine at station B and section 77 on the turn-over machine at station C).

The other conveyor flight comprises conveyor sections 69, 12, 46, 16, 95, 20, 145, 24, 145 and 28 (section 69 is on the turn-over machine; section 46 on the second jolt machine 15 at station D; section 95 on the squeeze machine; section 145 occurs on each of the draw and close machines). By having these two conveyor flights run side by side in close proximity, I am able to dispose the turn-over machine at the delivery ends of the first flight and the receiving end of the second flight to receive the flasks from one flight and to deliver them to the other as above described. I am also able to have stations B and D directly opposite each other and immediately adjacent each other to be served by a single sand hopper. I am also able to have the drawing station in close proximity to the starting station to facilitate the return of the patterns and flasks to the position where these are reassembled.

From a method standpoint, it is very advantageous to have the operations divided in order that they may be performed in the following sequence: Flask and pattern assembly; drag flask filling and jolting; application of bottom board and inversion; cope flask filling and jolting; squeezing the complete mold (with sprue hole cut if required); drawing the cope and pattern; setting cores; closing the mold and stripping the flask.

Of course, the drawing and closing apparatus, duplicated at stations F and H, is of great importance in conjunction with the conveyor which sets the timing for the entire operation and relieves most of the manual labor involved. Elsewhere I have found it desirable that the pattern and flask assemblies be moved manually from station to station.

In all of the various machines which exert pressure or vibration, it will be noted that means is provided whereby the weight of the parts is shifted from the conveyor rollers to a suitable table to relieve the roller bearings of the stress of the various jolting and pressure operations.

I claim:

1. A mold making unit comprising the combination of a pair of conveyors disposed adjacent each other in substantially parallel relation, the delivery end of one conveyor terminating adjacent the receiving end of the other, one of the conveyors having a flask filling station intermediate its ends, together with an inverting machine connecting said ends and providing means for transferring work from the said delivery end of one conveyor to the said receiving end of the other, the inverting machine comprising a machine base provided with a pintle, an invertible sub-frame pivoted on the pintle and comprising spaced conveyor sections adapted in the relatively inverted positions of the sub-frame to register endwise with the respective conveyors aforesaid, and means for moving one of said sections toward the other whereby work may be clamped between said sections during the inverting movement of said sub-frame.

2. In a device of the character described, the combination of a draw machine and a close machine each comprising a table and an elevator, the table of each machine being independently movable on its elevator between retracted and elevated positions, a relatively stationary conveyor section extending between the respective tables at the level of their respective retracted

positions, and a second conveyor in an elevated position above the respective tables and extending between said machines.

3. In a device of the character described, a draw machine and a close machine each including a table, an elevator for the table upon which the table is movable between elevated and retracted positions, a conveyor including a section between said machines and other sections normally extending over the respective tables in the retracted positions thereof and with respect to which the respective tables are substantially vertically movable to lift from the elevator sections last mentioned and restore to such sections the weight of work pieces delivered over the respective tables on said conveyor, and an overhead conveyor spanning the space between the respective machines and comprising a work supporting carriage independently toward and from which the respective tables are movable upon their respective elevators.

4. The combination set forth in claim 3 in which each of said machines comprises a track for said carriage and said carriage is provided with clutch means engageable and disengageable with the overhead conveyor.

5. The combination set forth in claim 3 in which each of said machines comprises a track for said carriage and said carriage is provided with clutch means engageable and disengageable with the overhead conveyor, each machine comprising a clutch disengaging cam and a carriage centering stop.

6. In a device of the character described, the combination with a conveyor including a work table having work positioning means and an elevator, of an overhead track, an overhead conveyor operable along said track, a carriage provided with a conveyor clutch for connection with the overhead conveyor, a fixed position carriage centering stop above the table and having a member movable into the path of the carriage to center the carriage above the work positioning means on the table, and a handle provided with a connection with said stop member and with a clutch actuating member for the alternate operation thereof, whereby the carriage may be directly centered above the table to receive work centered thereon and the stop member removed from the path of carriage movement simultaneously with the engagement of the clutch to convey the carriage from centered position and away from the table.

7. In a device of the character described, the combination with a conveyor, a vertically reciprocable elevator served by the conveyor, an overhead conveyor above the conveyor first mentioned and having a carriage track along the path of said overhead conveyor, and a carriage movable on the track and provided with a clutch for detachable connection of the carriage with said overhead conveyor, of a centering device on the elevator for positioning work thereon received from the first mentioned conveyor, a carriage-centering stop for positioning a carriage declutched from the overhead conveyor on the track directly above work centered on the elevator, and work engaging hooks connected with the carriage for engaging work lifted thereto by the elevator, whereby work delivered to the elevator from the conveyor will be aligned with a carriage declutched from the overhead conveyor for the automatic engagement of the carriage hooks with the work.

8. In a device of the character described, the

combination with a vertically reciprocable table and an elevator therefor, of a centering device connected with the table for positioning work thereon, an overhead conveyor, a carriage track along the path of said conveyor, a carriage movable on the track and provided with a clutch for connection with said conveyor, a carriage centering stop for positioning the carriage on the track directly above work on said table and work supporting hooks connected with the carriage for engaging work lifted thereto on said table, in further combination with a universally tiltable mounting for said table on said elevator, and work positioning means connected with the carriage, said table being universally yieldable when work thereon is engaged by said positioning means.

9. In a device of the character described, the combination with a conveyor comprising supporting trolleys, connective links mounted thereon, and a flexible support comprising a continuous uniform surface throughout its length suspended from said links, of a carriage having relatively adjustable jaws movable to and from clamping engagement with said flexible support for connecting and disconnecting the carriage with said conveyor.

10. In a device of the character described, the combination with a conveyor comprising supporting trolleys, connective links mounted thereon, and a flexible support comprising a uniform surface throughout its length suspended from said links, of a carriage having relatively adjustable jaws comprising a clutch movable to and from clamping engagement with said flexible support for connecting and disconnecting the carriage with said conveyor, said carriage having wheels, together with a track along which said wheels roll, a clutch disengager at one point along said track, and a manually operable clutch engager at another point along said track.

11. In a mold making machine a pair of conveyors in side-by-side relationship for series movement of mold forming elements in opposite directions to and from a station where one of said conveyors has its delivery end and the other of said conveyors has its receiving end, each of said conveyors having at said ends a separate conveyor section bodily movable into and out of alignment with its conveyor, a roll-over machine having a sub-frame upon which said separate conveyor sections are mounted in spaced relation and means for clamping the mold in assembled position on said sub-frame; said roll-over machine being positioned in series between said conveyors, and said sub-frame being swingable to alternatively align said delivery section or said receiving section with mold elements thereon in position for travel on one or the other of said conveyors.

12. The mold making machine of claim 11, wherein said subframe is provided with a movable jaw portion as a mounting for one of said sections for movement toward and away from the other of said sections and comprising said clamping means.

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