Oct. 24, 1950 W. F. HUCK 2,526,753

STEREOTYPE PLATE CASTING MACHINE

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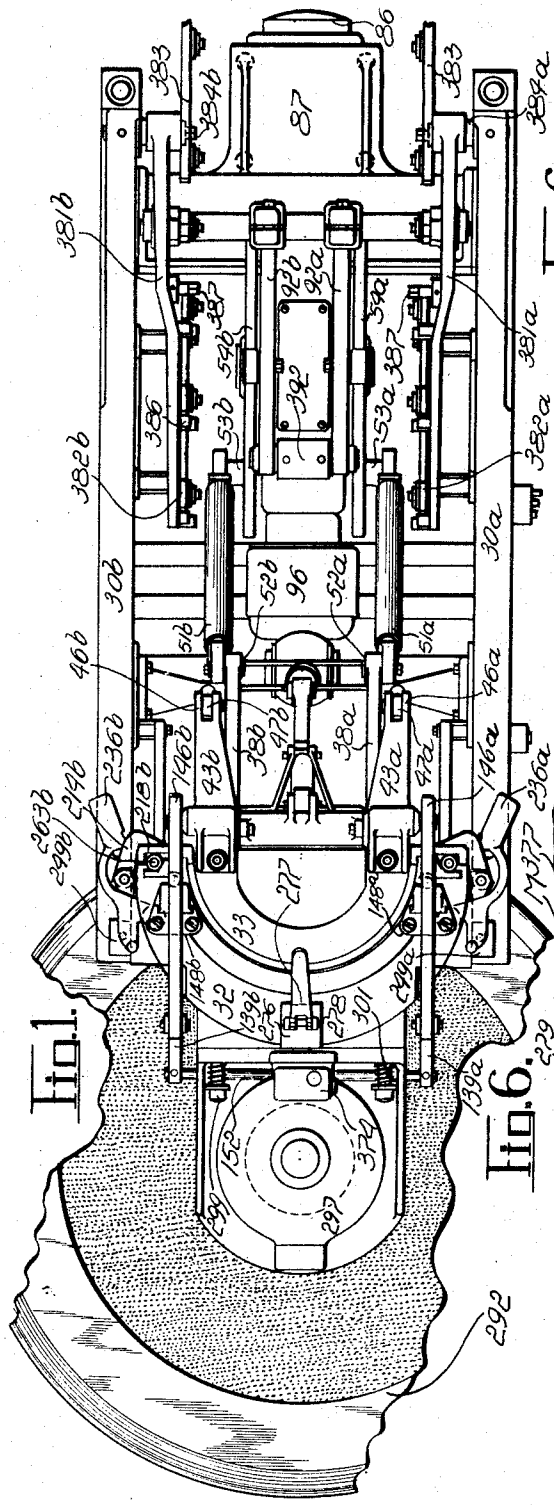


Fig. 1.

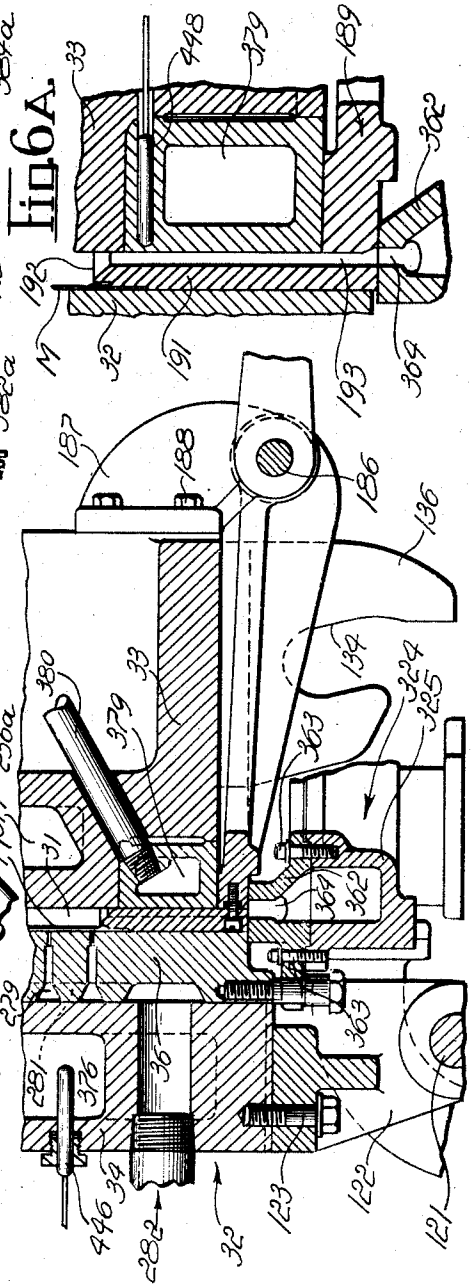


Fig. 6A.

Fig. 6.

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STEREOTYPE PLATE CASTING MACHINE

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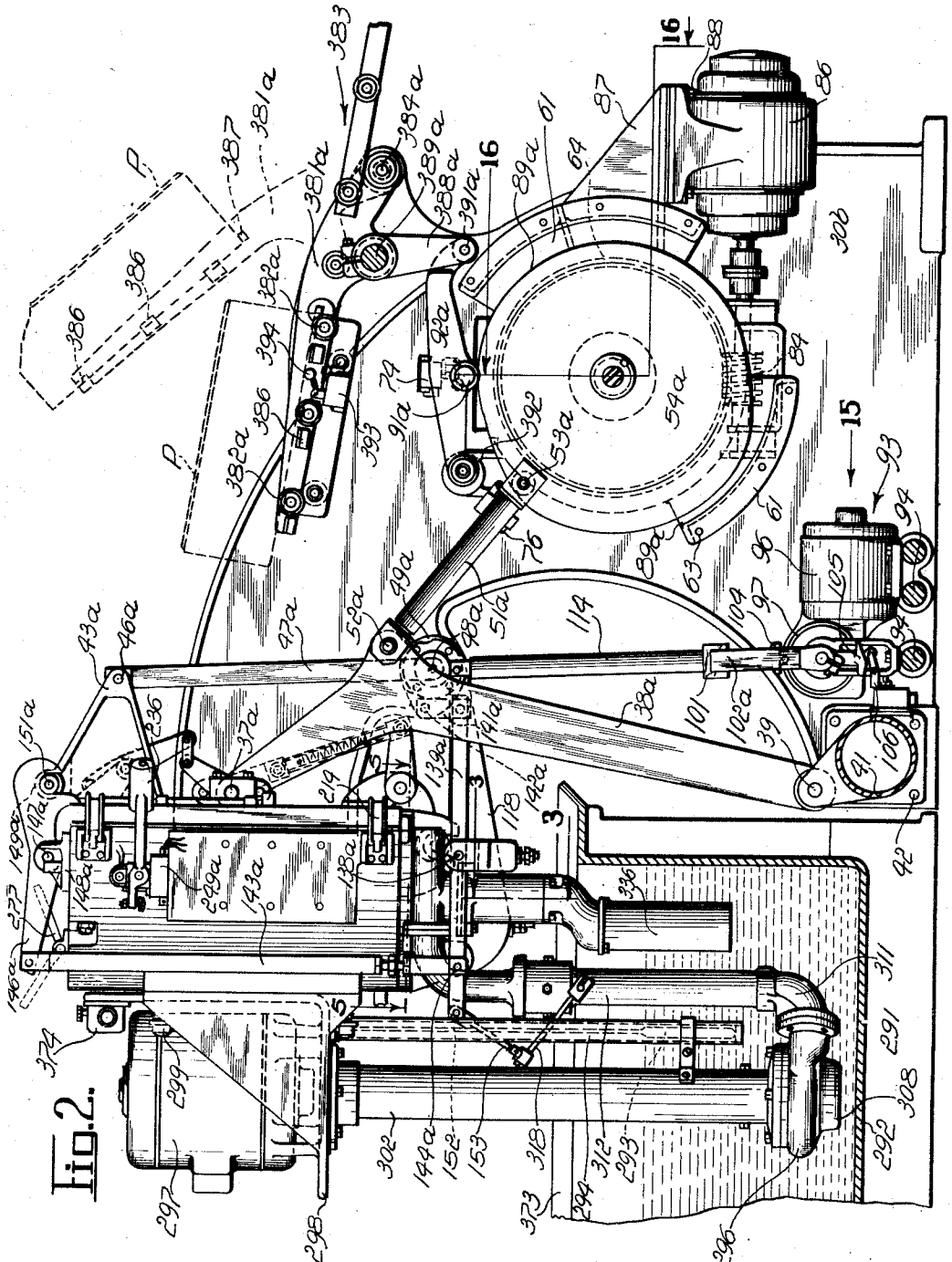


Fig. 2.

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STEREOTYPE PLATE CASTING MACHINE

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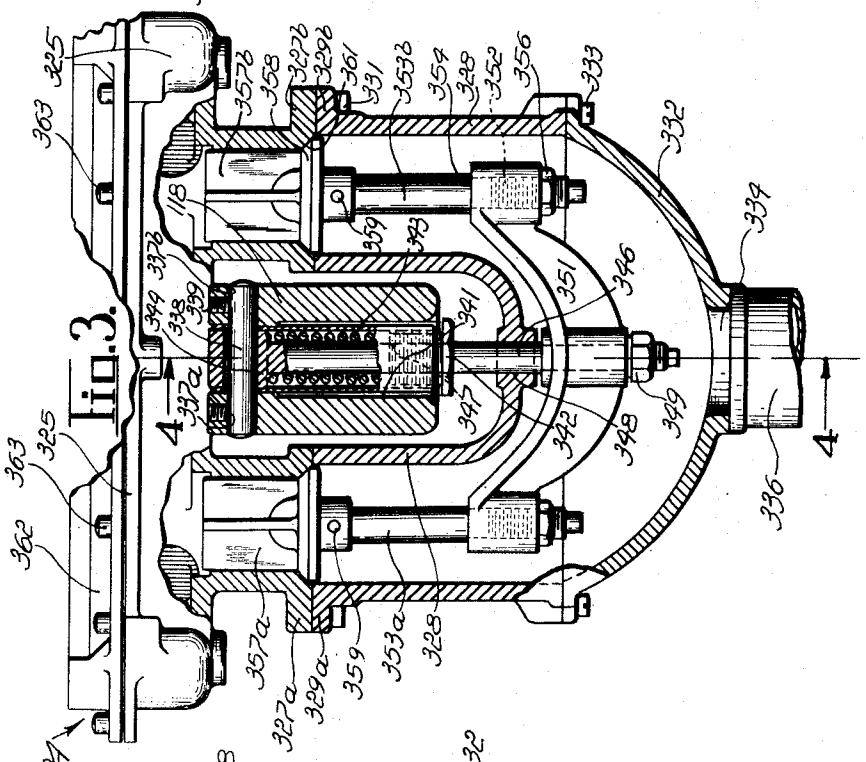


Fig. 3.

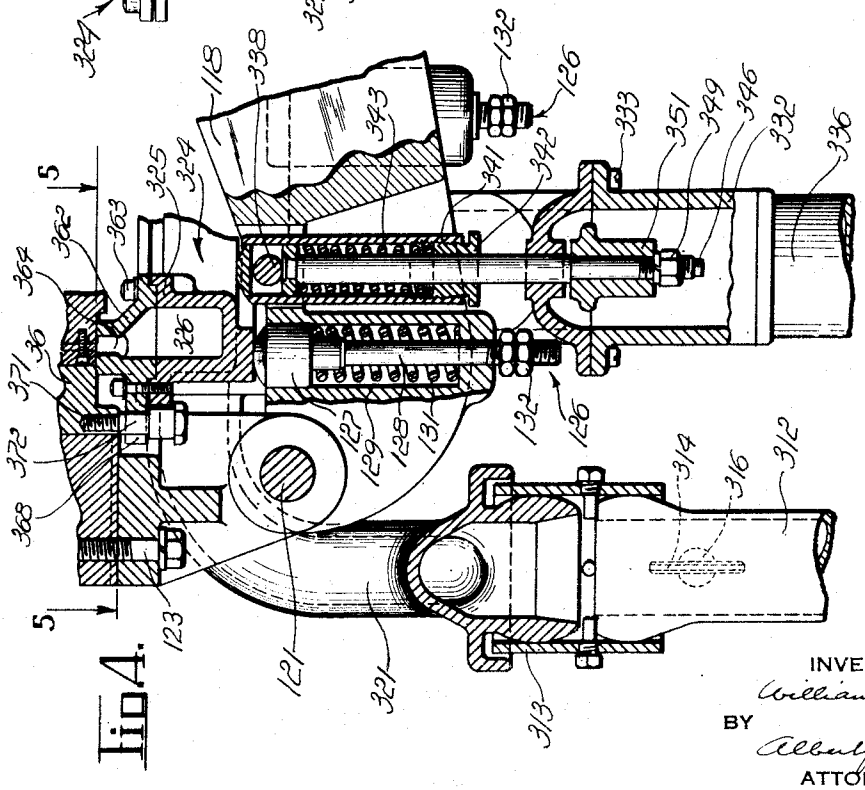


Fig. 4.

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STEREOTYPE PLATE CASTING MACHINE

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Fig. 7.

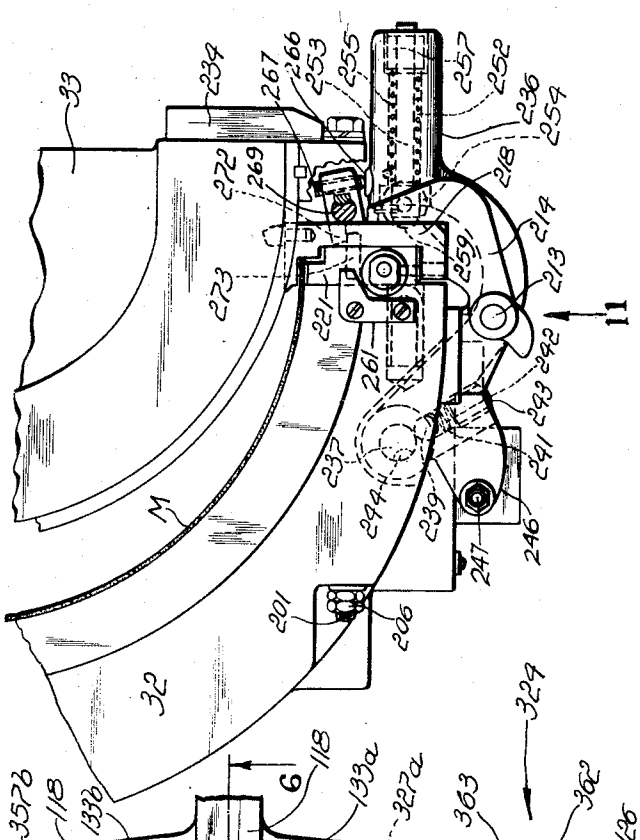
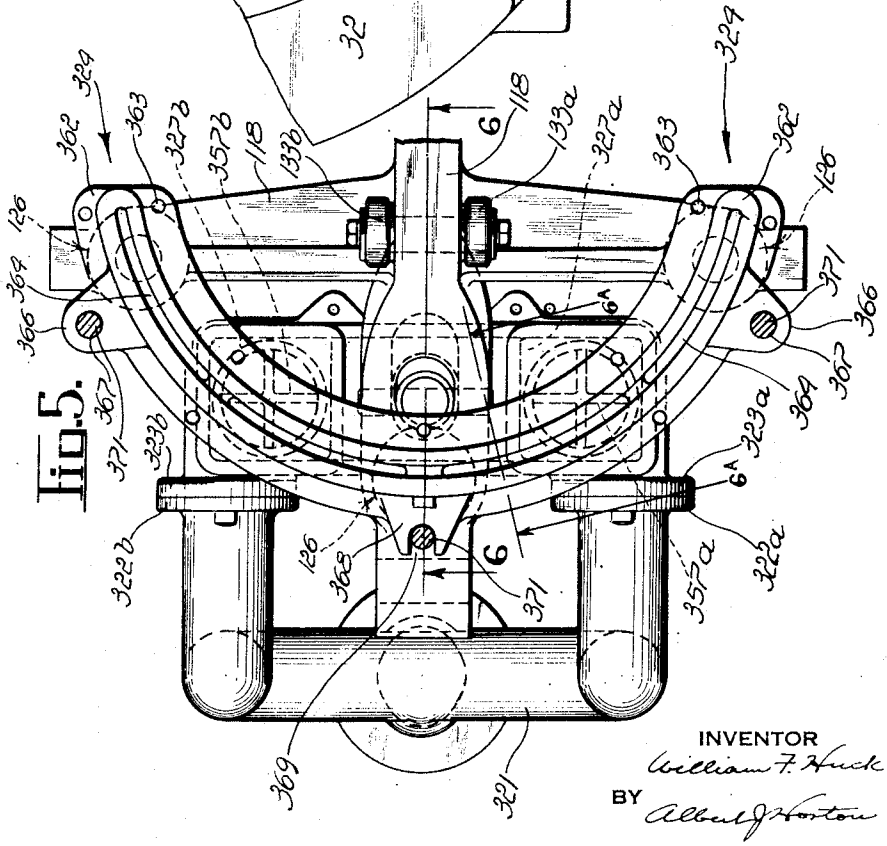


Fig. 5.



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STEREOTYPE PLATE CASTING MACHINE

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Fig. 8.

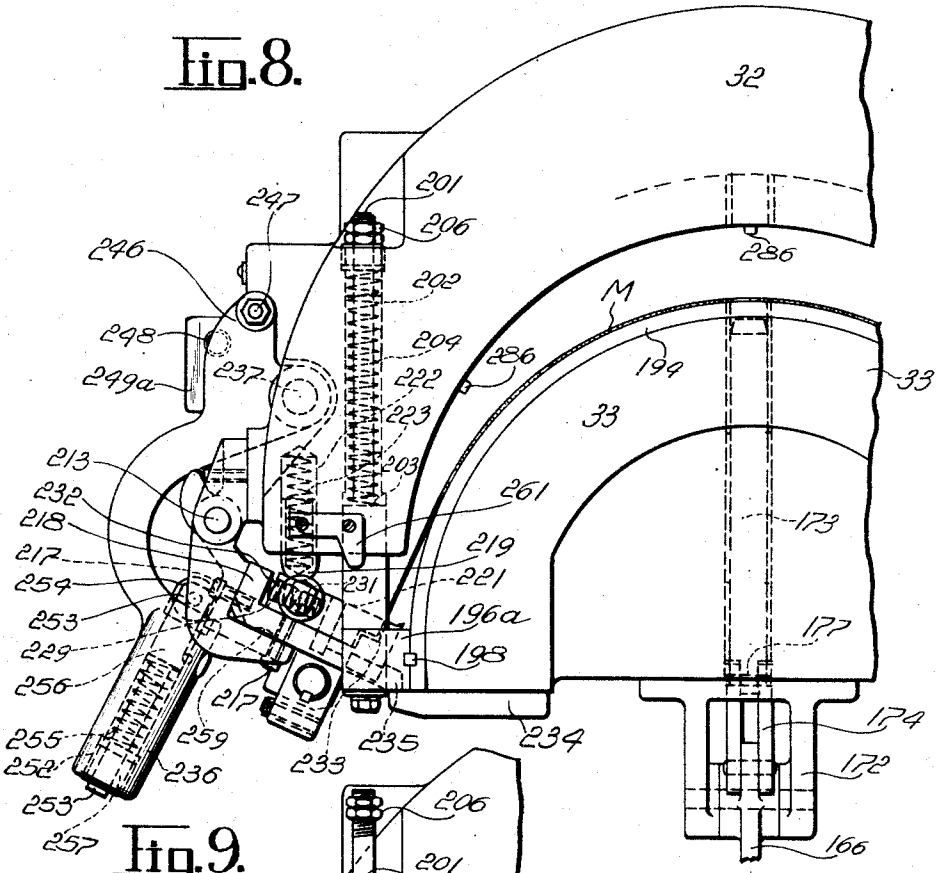


Fig. 9.

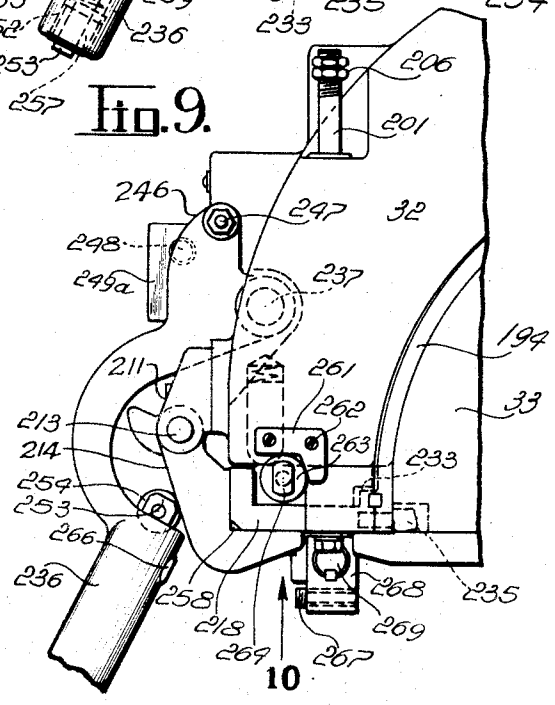
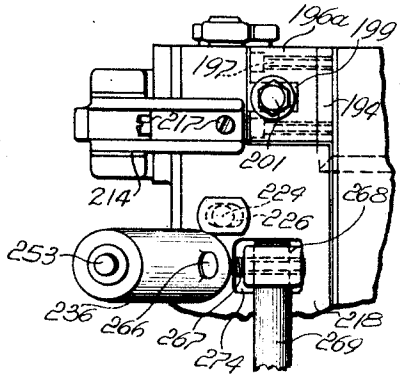


Fig. 10.



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Fig. 11

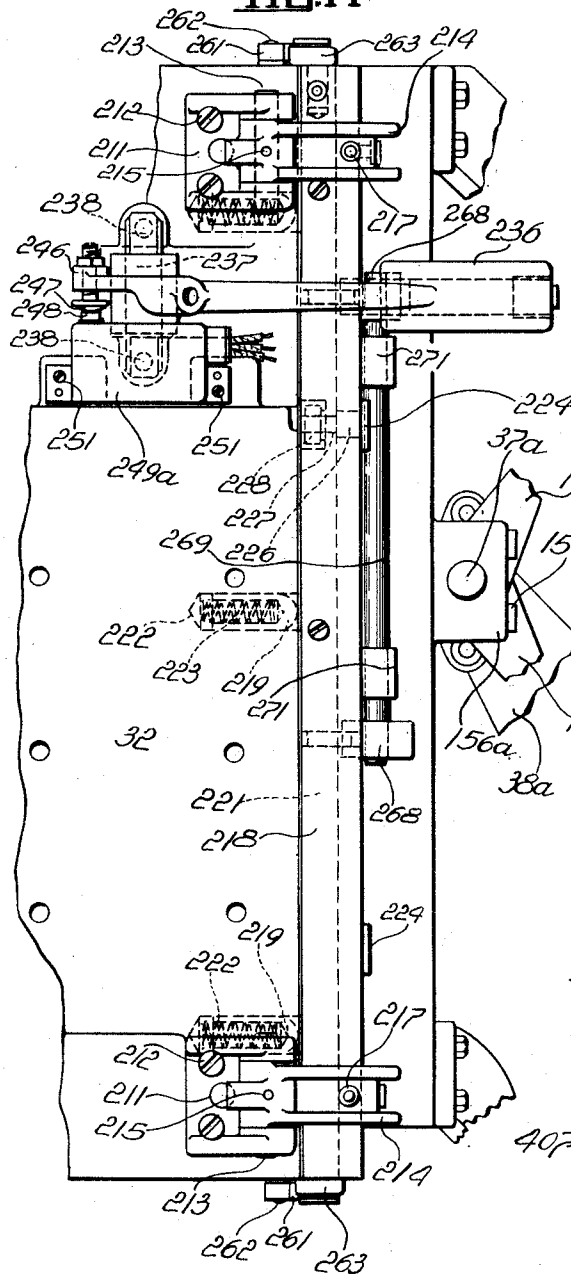


Fig. 22.

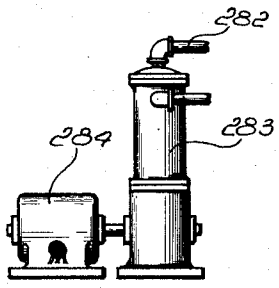
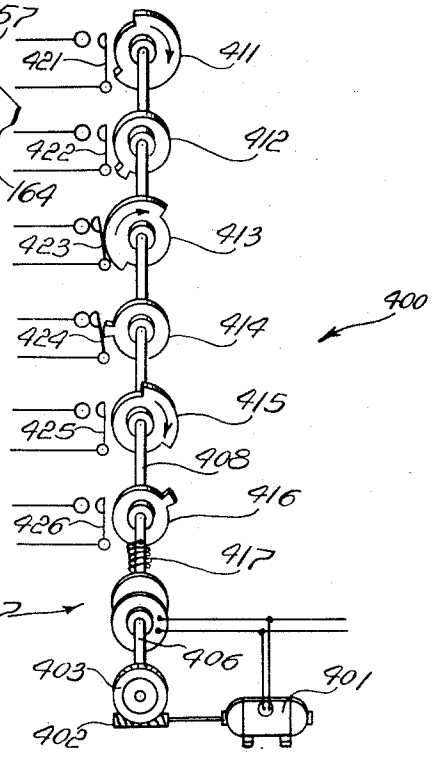


Fig. 23.



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Fig. 12.

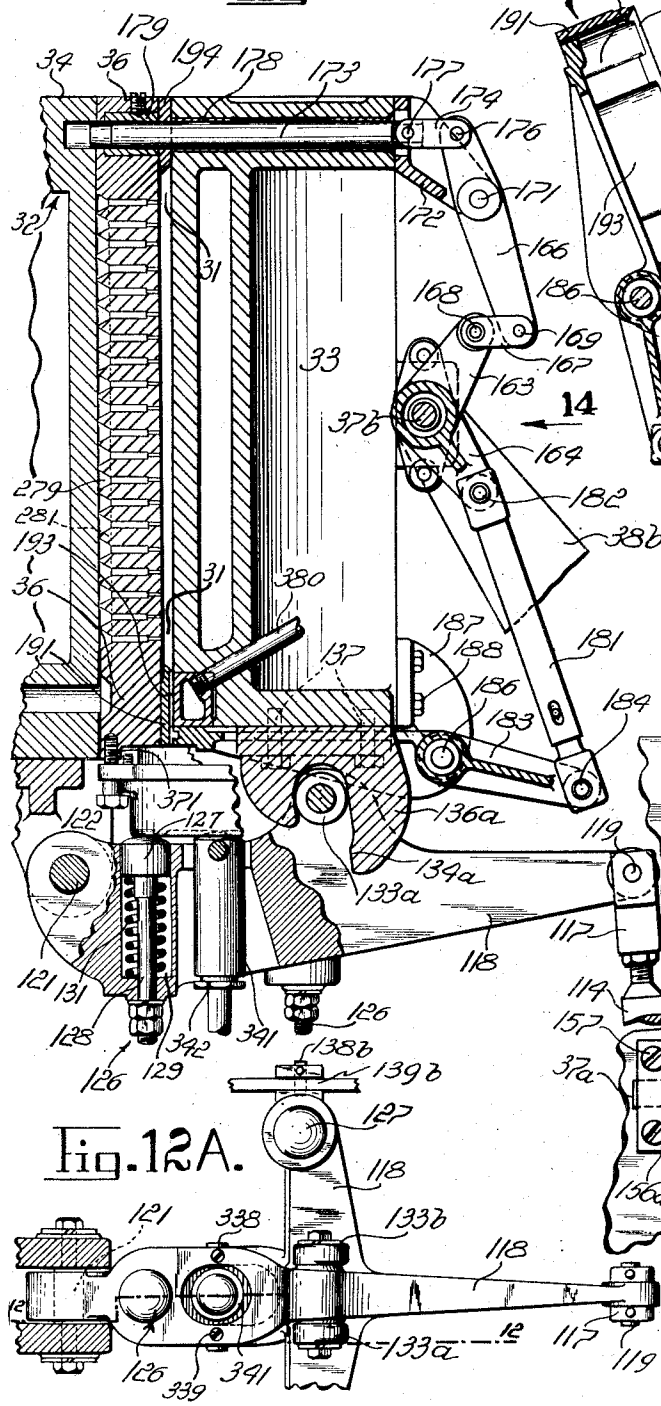


Fig. 13.

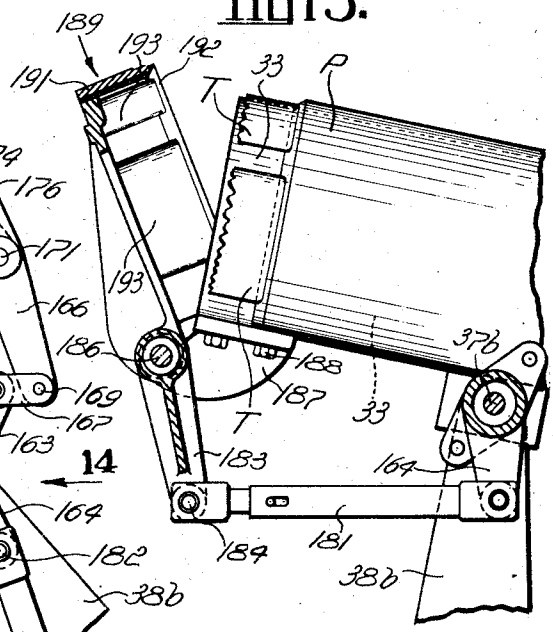


Fig. 14.

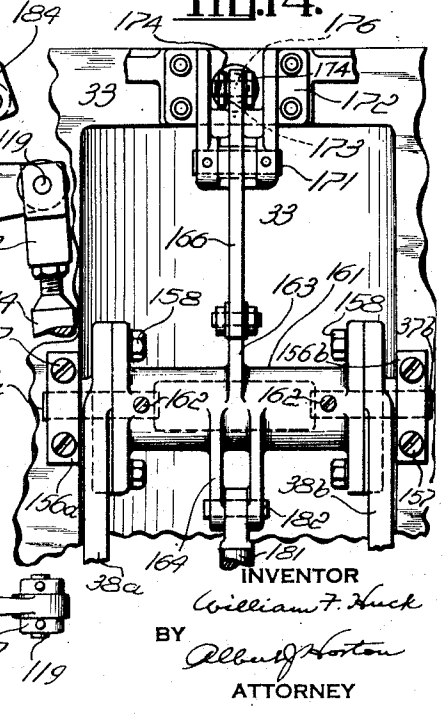


Fig. 12A.

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STEREOTYPE PLATE CASTING MACHINE

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Fig. 15.

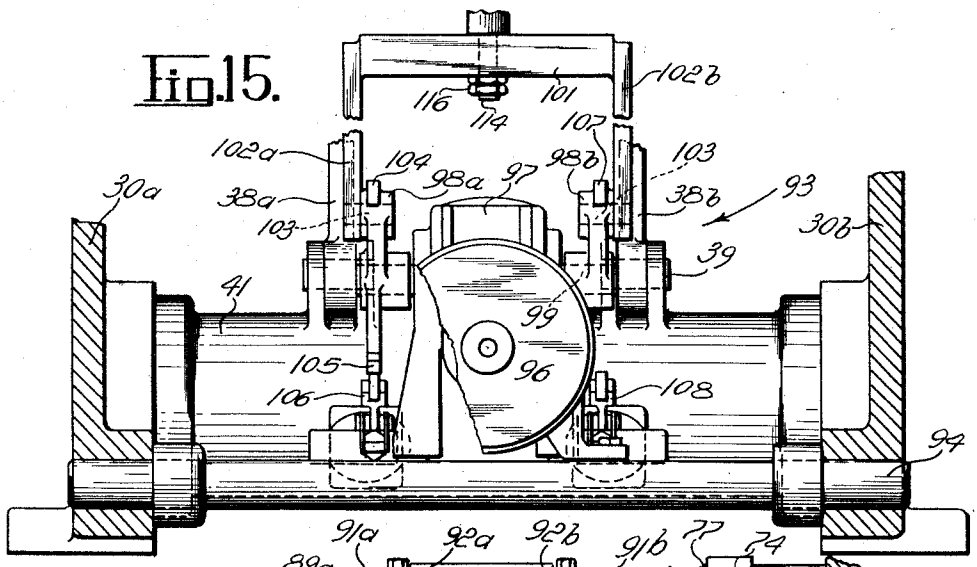
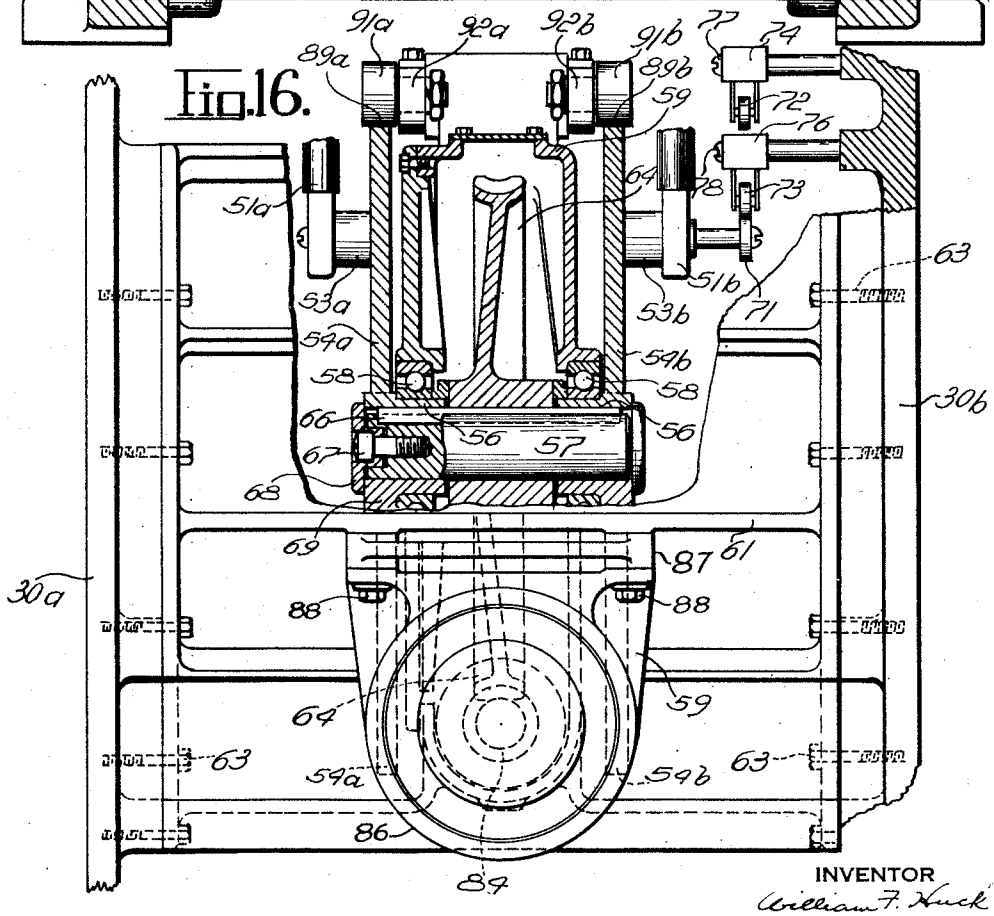


Fig. 16.



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STEREOTYPE PLATE CASTING MACHINE

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Fig. 17.

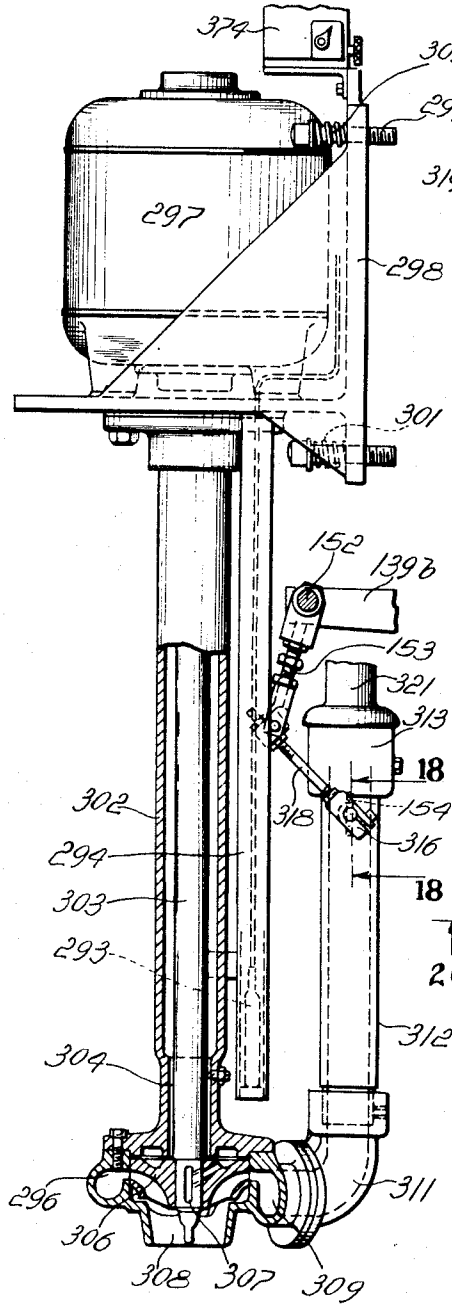


Fig. 18.

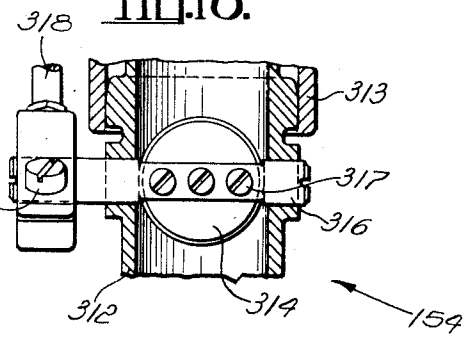


Fig. 19.

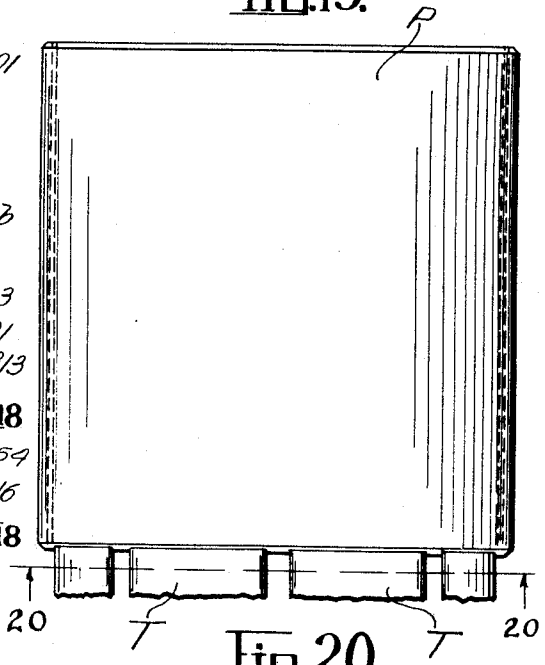
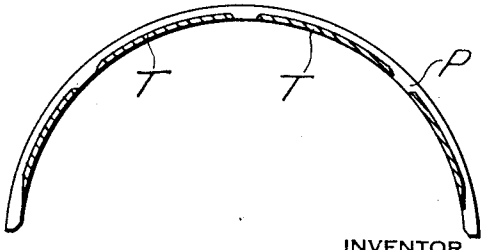


Fig. 20.



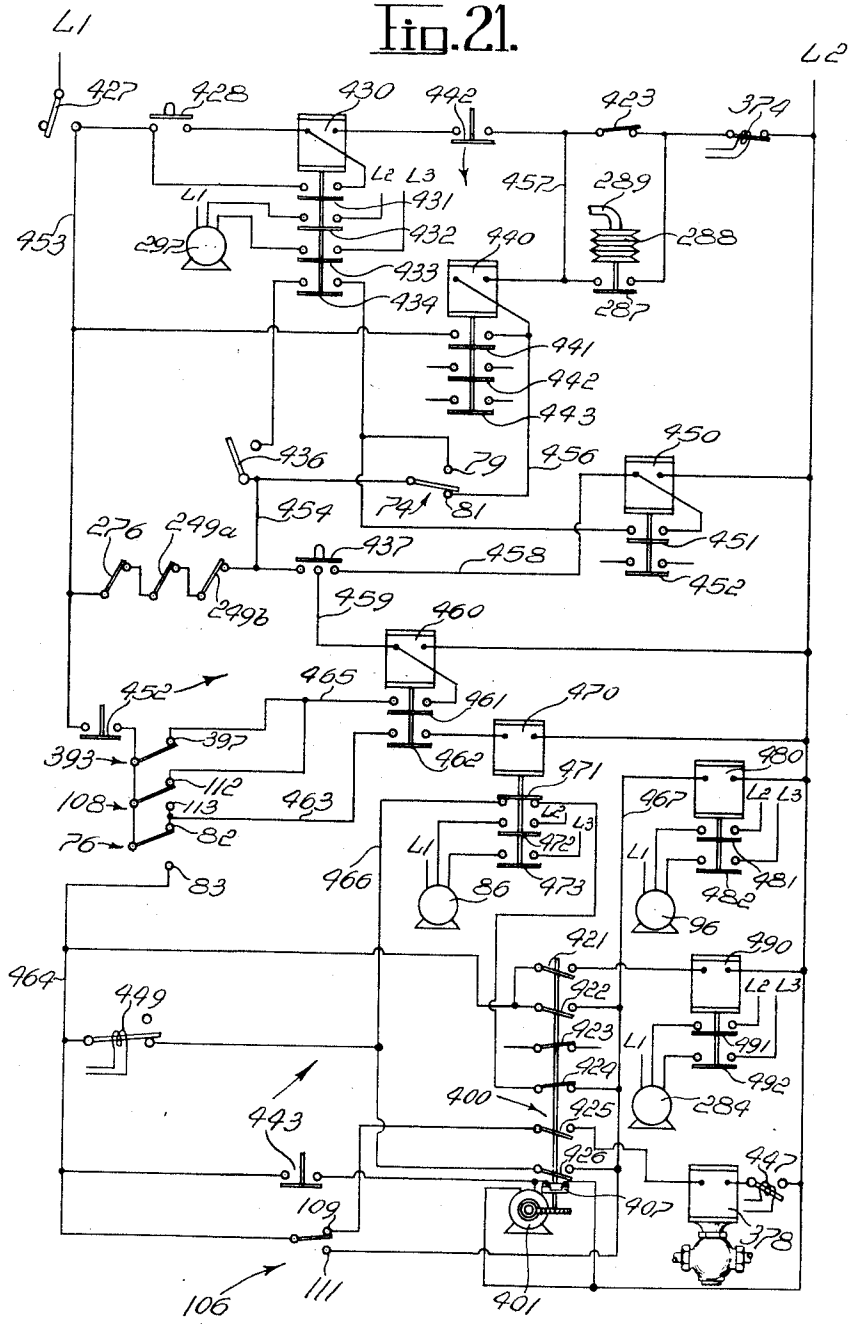
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STEREOTYPE PLATE CASTING MACHINE

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Fig. 21.



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STEREOTYPE PLATE CASTING MACHINE

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Fig. 24A.

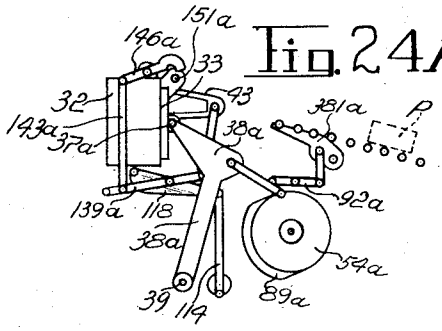


Fig. 24E.

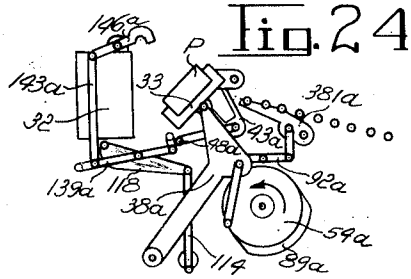


Fig. 24B.

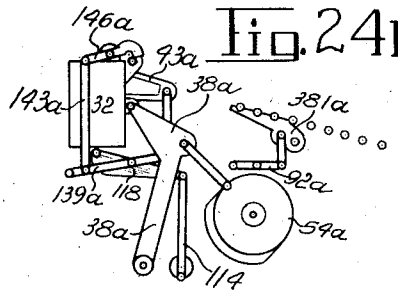


Fig. 24F.

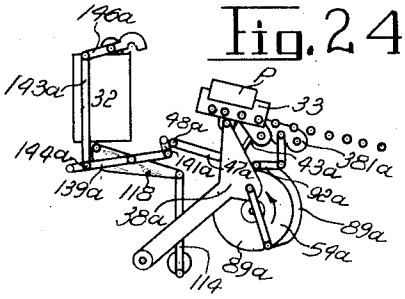


Fig. 24C.

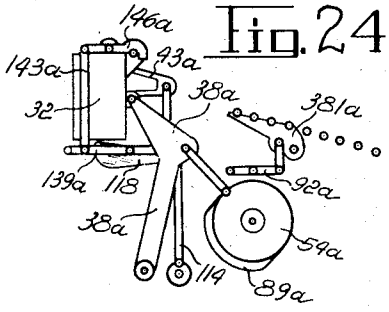


Fig. 24G.

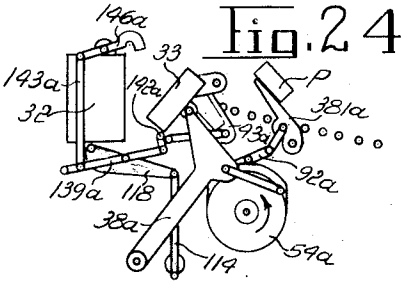
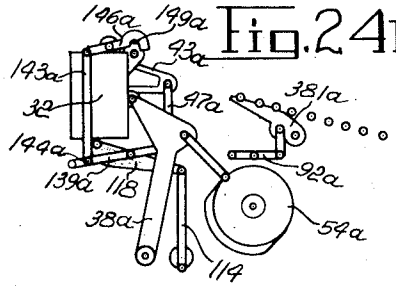


Fig. 24D.



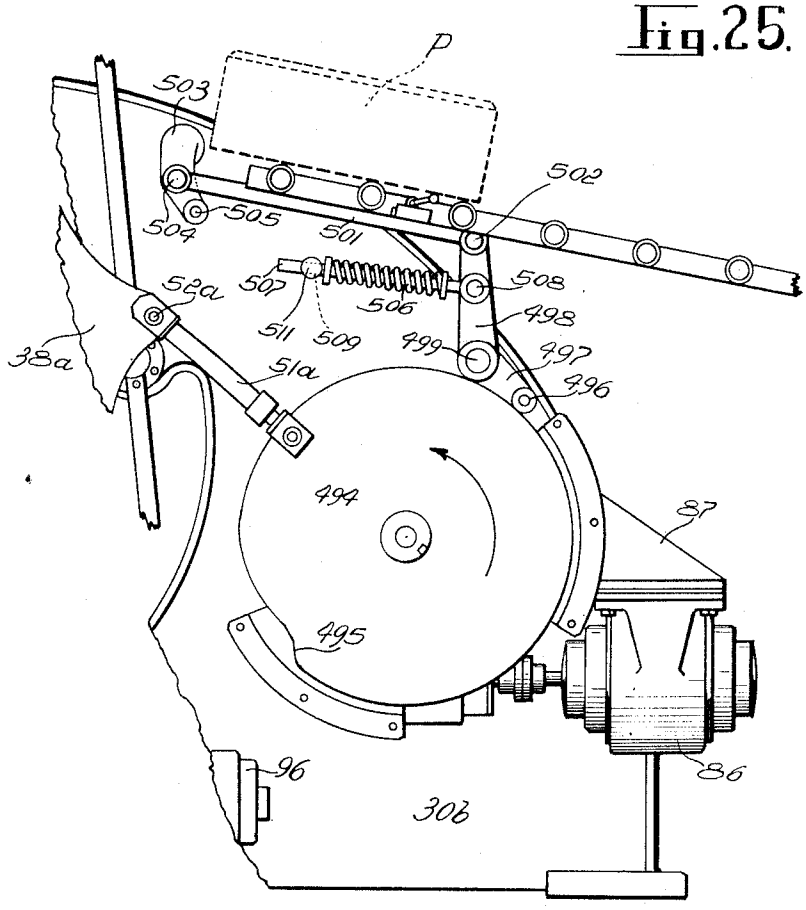
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STEREOTYPE PLATE CASTING MACHINE

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Fig. 25.



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Patented Oct. 24, 1950

2,526,753

UNITED STATES PATENT OFFICE

2,526,753

STEREOTYPE PLATE CASTING MACHINE

William F. Huck, Forest Hills, N. Y., assignor to R. Hoe & Co., Inc., New York, N. Y., a corporation of New York

Application June 14, 1945, Serial No. 599,474

2 Claims. (Cl. 22—2)

1

This invention relates to casting stereotype printing plates for use with rotary printing machines, and more particularly to improved methods and means for casting and automatically handling such plates.

One object of the invention is to provide an improved stereotype printing plate casting machine that will cast plates without heavy tails.

Another object of the invention is to provide an improved stereotype plate casting machine in which molten metal is constantly circulated through the ducts by means of which it is carried to the casting mould.

Another object of the invention is the provision of an improved stereotype plate casting machine in which all of the operating mechanism is conveniently accessible, yet any molten metal escaping from the machine will drain into the pot.

Another object of the invention is the provision of an improved stereotype plate casting machine that will automatically cast any desired number of plates, and provided with interlocking control mechanism for preventing improper operation of the machine.

Other objects of the invention will become apparent from the following description and claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, wherein:

Figure 1 is a plan view of a stereotype plate casting machine in which features of the invention are incorporated, the mechanism being shown with the casting mold closed;

Figure 2 is a side elevation partly in section, of the machine shown in Figure 1;

Figure 3 is a sectional view on the vertical line 3—3 of Figure 2 seen in the direction of the arrows, and showing by-pass valves and associated mechanism;

Figure 4 is a sectional view on the vertical line 4—4 of Figure 3, showing a spout for supplying molten metal to the casting chamber;

Figure 5 is a plan view showing a lower portion of the mechanism on the line 5—5 of Figure 2, the upper portion having been removed;

Figure 6 is a sectional view of a vertical plane at the center of the mold members and on the lines 6—6 of Figure 5, including parts of the mold members, not shown in Figure 5;

Figure 6A is a fragmentary vertical sectional view, similar to Figure 6, but showing the section at the line 6A—6A of Figure 5;

Figure 7 is a fragmentary plan view of a corner of the casting mold showing the back and core

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members of the casting mold in their relative positions at the start and finish of a plate casting cycle of operation, which is referred to herein as the "starting" position, and with the matrix clamps opened to permit removal or insertion of a matrix;

Figure 8 is a view similar to Figure 7, with the matrix clamps closed and gripping a matrix;

Figure 9 is a view similar to Figure 8 showing the parts as they appear when the mold is fully closed;

Figure 10 is a fragmentary view of a portion of the mold as seen in the direction of the arrow 10 of Figure 9;

Figure 11 is an elevational view of the outside of the mold generally as seen in the same direction as Figure 2, but with some of the parts omitted, and other parts as viewed in the direction of arrow 11 in Figure 7;

Figure 12 is a vertical sectional view, the upper portion as seen along the center line, and the lower portion along the broken line 12—12 of Figure 12A and showing a portion of the mold, and of the mechanism for aligning the mold members and locking them in casting position;

Figure 12A is a plan view of a portion of the mechanism shown in Figure 12 with the mold members and spout removed;

Figure 13 is a detailed view partly in section showing some of the parts shown in Figure 12, when the core is in the plate discharge position shown in Figure 24F;

Figure 14 is a fragmentary view showing certain parts of the mold registering and locking mechanism as seen in the direction of the arrow 14 in Figure 12;

Figure 15 is a fragmentary outside elevational view partly broken away and partly in section showing the motor operated mold locking mechanism as seen in the direction of the arrow 15 in Figure 2;

Figure 16 is an elevational view partly broken away and partly in section, showing the motor operated core moving mechanism as seen on the broken line 16—16 of Figure 2;

Figure 17 is an elevational view partly in section showing the motor operated metal pump and associated parts;

Figure 18 is a fragmentary vertical sectional view showing the molten metal duct as seen on the line 18—18 of Figure 17;

Figure 19 is a face view of a stereotype printing plate cast by the machine;

Figure 20 is an end view of the plate showing the tails of the casting on the line 20—20 of

Figure 19 and looking in the direction of the arrow;

Figure 21 is a schematic electrical wiring diagram showing a preferred means for controlling the operation of the casting machine.

Figure 22 is a view showing a motor operated vacuum pump suitable for use with the casting machine;

Figure 23 is a schematic illustration of a motor operated timing device suitable for use with the casting machine;

Figure 24A to 24G are diagrammatic views showing various positions of certain moving members of the casting machine during its cycle of operation. Specifically Figure 24A shows the members in "starting" position, Figure 24B shows them in the nearly closed position, Figure 24C shows them in the fully closed or locked position, Figure 24D shows them in unlocked position, Figure 24E shows them in an intermediate transfer position, Figure 24F shows them in plate-discharge position, Figure 24G shows them in intermediate returning position; and

Figure 25 shows a modified form of plate discharge mechanism.

Referring to the drawings, the invention is shown as applied to a machine for automatically casting curved stereotype printing plates. Similar reference characters designate corresponding parts, with the subscripts "*a*" and "*b*" being used with the same numeral to designate similar parts disposed toward the front and toward the back of the machine, respectively. In some instances "*a*" or "*b*" parts are not shown on the drawings, but it will be understood that parts not shown are similar, except for location, to the parts that are shown. Main front and back side frame members **30***a* and **30***b* are arranged to conveniently support the machine components.

A closed semi-cylindrical casting chamber or mold **31**, (Figure 12) having a vertical axis, has one wall formed by a stationary concave outer-mold member, or back **32**, and another wall formed by a movable semi-cylindrical convex inner-mold member or core **33**. The back has an outer or water-cooled section **34** and an inner or vacuum section **36** bolted together by bolts (not shown), and the water-cooled section **34** is supported from the frame **30***a* and **30***b*.

Opening and closing the mold

The core **33** is carried by and swingable about pivot pins **37***a* and **37***b* (Figures 2 and 12) located at the upper end of a pair of main operating-arms **38***a* and **38***b* (Figure 1), respectively, that are pivotally mounted on pins **39** (Figure 2) carried by a cross brace **41** secured at its opposite ends to the main frames **30***a* and **30***b* by means of bolts **42**. A pair of brackets **43***a* and **43***b* (Figure 1), secured to the core **33**, each carry pins **46***a* and **46***b* to which the upper ends of links **47***a* and **47***b*, are pivotally connected, and the lower ends of their links are fulcrumed from fixed pins **48***a* carried by brackets **49***a* supported from the frames **30***a* and **30***b*. Connecting rods **51***a* and **51***b* are pivotally secured to the arms **38***a* and **38***b* at intermediate points by pins **52***a* and **52***b*, and the other ends of the rods **51** are pivotally carried on the ends of pins **53***a* and **53***b* that protrude from opposite faces of a pair of main crank plates **54***a* and **54***b*.

The crank plates **54***a* and **54***b* (Figure 16) each have an inwardly extending tubular portion **56** fitted to a shaft **57**, that is rotatably mounted in ball bearings **58**, supported from a housing **59**, secured to cross members **61** (Figure 2). The cross members are secured between the main frame members **30***a* and **30***b* by bolts **63** (Figure 16). The housing **59** encloses a worm wheel **64** that is keyed to the shaft **57** by a key **66**, which also keys the crank plates **54***a* and **54***b* to the shaft **57**, thus causing the worm wheel **64** and the crank plates to rotate as a unit. Bolts **67** and end plates **68** cooperate with hubs **69** on the crank plates **54** to hold these plates on the ends of the shaft **57**. An extension of the pin **53***b* carries a roller **71** that cooperates with operating rollers **72** and **73**, depending from limit-switches **74** and **76** (Figures 2, 16 and 21) secured to the frame **30***b* by bolts **77** and **78**. The switch **74** (Figures 16 and 21) has a normally-closed contact **79** and a normally-open contact **81**, the latter being closed by the roller **71** when the casting machine is in the starting position shown in Figure 24A. The switch **76** has a normally-closed contact **82** and a normally-open contact **83**, the latter being closed by the roller **71**, when the casting machine is in the position shown in Figure 24B.

The worm wheel **64** rotates in one direction only and is driven by a worm **84** (Figures 2 and 16), which is driven by a main operating motor **86** that is supported from a bracket **87** by bolts **88**, the brackets being secured to the cross members **61**. The peripheries of the crank plates **54***a* and **54***b* form cam surfaces **89***a* and **89***b* respectively, which engage rollers **91***a* and **91***b* secured to levers **92***a* and **92***b*. Operating the motor **86** causes the arms **38***a* and **38***b* and thus the core **33**, to move from the "starting" position shown in Figure 24A through the intermediate positions shown in Figures 24B, 24C, 24D, 24E, 24F, 24G and back to the "starting" position. When the core **33** is in the position shown in Figure 24F, the newly cast plate P is removed from the core **33** by means hereinafter fully described.

Locking the mold

A locking mechanism **93** (Figures 2 and 15) mounted on the tie rods **94**, the ends of which are supported by the side frames **30***a* and **30***b*, functions to lock the core **33** to the back **32** during the casting operation. This mechanism includes a locking motor **96** (Figures 2 and 15) which runs in but one direction and drives a gear reducer **97** having cranks **98***a* and **98***b* on opposite ends of the output shaft **99**. The cranks drive a fork-shaped mechanism having a horizontal member **101** and two arms **102***a* and **102***b*, the latter being secured to the cranks by pins **103**. Operating the motor **96** moves the cranks **98***a* and **98***b* from the mold unlocked position shown in Figure 24B to the mold locked position shown in Figure 24C, and a second operation of the motor **96** in the same direction moves the cranks to the unlocked position shown in Figure 24D. The crank **98***a* carries two cams **104** and **105** disposed at 180 degrees relationship for operating a limit-switch **106**, and the crank **98***b* carries a cam **107** for operating a limit-switch **108**. The switch **106** (Figure 21) has a normally-open contact **109** and a normally-closed contact **111**, the latter being opened by the cam **105** when the mold is locked (see Figure 15), and by the cam **104** when the mold is unlocked. The switch **108** has a normally-closed contact **112** and a normally-open contact **113**, the former being opened and the latter being closed by the cam **107** for a very short period of time just before the lock-

ing mechanism arrives at the unlocked position shown in Figure 24D.

The lower end of a vertical rod 114 (Figures 2 and 15) is screwed into the central portion of the horizontal member 101, and is locked thereto by a nut 116. The upper end of the rod 114 (Figures 2 and 12) is adjustably screwed into one end of a lug 117, the other end of which is pivotally connected to one end of a yoke 118 by a pin 119. The yoke 118 is pivoted on a pin 121 supported from a bracket 122 (Figures 6 and 12), depending from the bottom of the back 32 and secured thereto by bolts 123. The yoke 118 carries three spring pressed plungers 126, which, as hereinafter shown, assist in closing the bottom of the mold. Each plunger (Figure 4) has a head 127, a stem 128, and is movable in a hole 129 in the yoke 118. A compression spring 131 is positioned between the head 127 and the bottom of the hole 129 to normally bias the plunger in an "up" position. Nuts 132 are screwed to the lower end on the stem 128 to limit the motion of the plunger 126 by contacting the outside of the yoke 118. The yoke carries rollers 133*a* and 133*b* (Figure 12A) for engaging a pair of U-shaped lower locking cams 134*a* one of which is shown in Figure 12. These cams are formed as parts of a twin bracket 136*a* that is secured to the bottom of the core 33 by bolts 137. The yoke 118 also carries two pins 138*a* and 138*b* (Figures 2 and 12A) that pivotally support a pair of horizontal levers 139*a* and 139*b*, respectively (Figures 2 and 12A), the right ends of which, as viewed in Figure 2, are pivotally connected to short links 141*a* that are pivotally supported by pins 142*a* carried by brackets 49*a* hereinbefore mentioned. The bottom ends of a pair of vertical rods 143*a* are pivotally connected to the horizontal levers 139*a* and 139*b* by means of pins 144*a*, and the upper ends of these vertical rods are pivotally connected to the ends of head locking levers 146*a* and 146*b* (Figure 1), that are fulcrumed on pins 147*a* (Figure 2) supported from a top portion of the back 32 by brackets 148*a* and 148*b* (Figure 1). The free ends of the locking levers 146*a* and 146*b* are provided with U-shaped cams 149*a* for engaging rollers 151*a* (Figure 2), carried by the brackets 43*a* and 43*b*.

Retractable registering pin

The pins 37*a* and 37*b* (Figures 2, 12 and 14) are pivotally supported in brackets 156*a* and 156*b* secured to the core 33 by bolts 157. The arms 38*a* and 38*b*, by means of bolts 158 are fastened to opposite ends of a pivot mechanism 161 secured to the pins 37 by set screws 162. The mechanism 161 has arms 163 and 164 separated by an angle of approximately 110 degrees. The upper arm 163 of the pivot mechanism, is pivotally connected to the lower end of a lever 166 by a pair of links 167, and pivot pins 168 and 169. The lever 166 is pivotally supported from the core 33 by a pin 171 and a bracket 172. The upper end of the arm 166 is pivotally connected to the outer end of a retractable registering pin 173 by a pair of links 174 and pins 176 and 177. The retractable pin is reciprocatably mounted in a bore 178 located at the center of the top of the core 33. When in the position shown in Figure 12, the pin enters a bore 179 in the top of the back 32, thus bringing the core into proper alignment with the back.

Tail gauge

A means for closing the bottom of the semi-circular casting chamber 31 is provided under the control of the pivot mechanism 161, the lower arm 164 of which is pivotally connected to the upper end of a telescoping rod 181 by a pin 182. The lower end of the rod 181 is pivotally connected to a lever 183 by a pin 184, and the lever 183 is pivotally supported from a pin 186 carried by a bracket 187 that is secured to the core 33 by bolts 188. A semi-circular tail plate 189, formed as a part of the lever 183, and having a semi-circular tail gauge 191, beveled at 192, is thus swingable from the position shown in Figure 12 to that shown in Figure 13 by the operation of the mechanism 161. The tail gauge is provided with a plurality of recesses or gates 193 through which molten metal may flow to fill the mold. After the mold is filled with metal, the metal in the gates 193 solidifies, and forms relatively small tails T on the plate P (see Figures 13 and 19), which when cut off during a plate finishing operation, will fall clear of the operating parts of the finishing machine.

Head gauge

Means for closing the top of the casting chamber is provided and includes a beveled semi-circular head gauge 194 (Figures 8, 9, 10 and 12) supported at opposite ends by a pair of guide blocks 196*a* and 196*b* secured thereto by bolts 197 and aligned therewith by keys 198. Each block is provided with a slot 199 (Figure 10) which receives a flattened portion of a plunger rod 201 which slides in a hole 202 in the back 32. The rod is provided with a shoulder 203 for engaging a coiled spring 204 to normally bias the rod, the block 196 and head gauge 194 to the position shown in Figure 8. Locking nuts 206 are threaded to the opposite end of the rod 201, and abut against a portion of the back 32 to thereby limit the movement of the rod. As the core 33 is moved toward the fully closed position, it abuts the head gauge 194, compresses the springs 204, and moves the head gauge to the position shown in Figure 9, closing the mold.

Side gauges

Means for gripping opposite edges of the matrix and for closing the two vertical edges of the semi-circular casting chamber 31 include upper and lower hinge blocks 211 (Figures 8, 9 and 11), secured to the back 32 by bolts 212, and provided with pins 213 that mount upper and lower hinges 214. The pins 213 are secured in the hinges by set screws 215. Bolts 217 carried by the upper and lower hinges, support on each side, a channel-shaped outer-side gauge member 218 that extends from the top to the bottom of the back 32. The gauges 218 are normally biased to the position shown in Figure 8 by a plurality of plungers 219 abutting an inner gauge member or matrix clip 221 carried by the outer gauge member 218. The plungers 219 operate in holes 222 drilled into the back 32 and are pressed forward by compression springs 223. The matrix clips 221 are slidably held in the channel of the side gauge 218 by bolts 224 (Figures 10 and 11), extending through slotted holes 226 in the outer side gauge and into holes 227 in the inner gauge member 221, and nuts 228 screwed to the bolts 224 are positioned in a counter-sunk portion of holes 227. A plurality of compression springs 229 (Figure 8), carried in holes 231, opening on an edge 232 of the clip 221, bias the clip to normally press the other edge thereof against the inside portion of the channel, thus forming a jaw 233 extending from

top to bottom of the mold for gripping one edge of the matrix M.

Two separate means are provided for moving the side gauges from the spring biased position shown in Figure 8. One of these include plates 234 carried at each side of the core 33 and positioned to engage pins 235 protruding from the side gauges 218. When the mold is fully closed by moving the back from the position shown in Figure 8 to the position shown in Figure 9, the plates 234 engage the pins 235 and close the side gauges by swinging them on their hinge pins 213. The other means for closing the side gauges include manually operated gauge locking handles 236, pivotally carried on fixed shafts 237, that are secured on each side of the back 32 by bolts 238 (Figure 11). Each locking handle includes a steel ball 239 (Figure 7) carried in a hole 241 and pressed against the shaft 237 by a spring 242 held in position by a set screw 243. Each ball engages a small recess 244 in the haft 237 to hold the handle in the normally open position. An arm 246 formed as a part of the handle 236 carries a button 247 (Figures 8, 9 and 11) for engaging an operating button 248, of a normally closed limit switch 249*a* that is secured to the back 32 by bolts 251. Placing the handles 236 as shown in Figure 7, opens the switches 249*a* and 249*b* and prevents operation of all portions of the machine except the metal pump. A hole 252 in each handle 236 carries a plunger 253 that has a bifurcated end for mounting a roller 254. A shoulder 256 on the plunger 253 is engaged by a compression spring 255 that is retained in the hole 252 by a plug 257 screwed thereinto. When the handle 236 is swung from the position shown in Figure 8 toward the position shown in Figure 7, the spring pressed roller 254 engages a beveled edge 258 of the side gauge 218, and thus closes the side gauge. When the side gauge is fully closed, the roller 254 enters a recess 259 in the face of the side gauge and thus functions to hold the side gauge and the handle in the closed position shown in Figure 7.

When the side gauges 218 are closed by the plates 234 engaging the return pins 235, a pair of cam brackets 261 secured to the top and bottom of the back 32 at each side by bolts 262, engage rollers 263 supported respectively from the top and bottom of each matrix clip 221 by bolts 264. This causes the clips 221 to move a very short distance against the compression of the springs 229, and thus to open the jaws 233 enough to release the grip of the side gauges on the matrix M. When each side gauge is closed by moving the handle 236, a boss 266 on the said handle engages a pin 267 (Figures 9 and 10) screwed into a throw-over lever 268 that is keyed to the top of a vertical shaft 269, which is supported from the back 32 by brackets 271 (Figure 11). A second throw-over lever 268 keyed to the bottom of the shaft 269 operates in unison with the upper lever, and lips 272 thereon (Figure 7) engage pins 273 protruding from the matrix clip 221 through holes 274 (Figure 10) in the side gauge 218. Thus turning the shaft 269 and the throw-over levers 268 from the position shown in Figures 8 and 9 to the position shown in Figure 7, moves the clip 221 to open the jaw 233 to a greater degree than was done when the jaw was opened by the cams 261 and roller 263. Opening the jaws 233 by means of the handle 236 when the core is partly open as shown in Figure 7, allows the removal or insertion of a matrix M.

In addition to the interlock switches 249*a* and 249*b* associated with the handles 236, interlock switch 276 (Figure 1) is mounted on the top of the back 32 and manually operated by a lever 277 hinged on a shaft 278. When the lever 277 is in the position shown by solid lines in Figures 1 and 2, the machine may be operated, but in this position the lever 277 interferes with insertion or removal of a matrix from the mold. Moving the lever to the position shown by dotted lines on Figure 2, clears the way for inserting or removing a matrix, but operates the switch 276 to prevent operation of the mold.

Positioning matrix by vacuum

As hereinbefore described, the matrix M is released from the jaws 233 by the cam 261 as the mold is fully closed. When this occurs, the air back of the matrix is exhausted through a multiplicity of holes 279 (Figure 6) extending from the concave side of the vacuum section 36 to a system of exhaust ducts 281 that are connected by piping 282 with a vacuum pump 283 (Figure 22) driven by a motor 284. When suction is applied to the back of the matrix M, a plurality of pins 286 (Figure 8), protruding from the vacuum section 36 engage matching holes in the edge of the matrix, and thus properly locate the matrix in the casting chamber. A vacuum switch 287 (Figure 21) has a bellows 288 connected by a pipe 289 with the holes 279. When the matrix M is in proper position, the holes 279 are sealed and the bellows closes the switch 287.

Metal supply

The means provided for supplying molten metal to the casting chamber 31, which is formed when the core 33 is fully closed and locked to the back 32, includes a stereotype metal furnace 291 having a melting pot 292 heated by any suitable means. A thermostat tube with a bulb 293 (Figure 2) enclosed in a pipe 294 controls the operation of a metal pump 296. If the temperature of the metal is too low for casting the metal pump will not start, and if it is running it will stop.

The centrifugal type hot metal pump 296 is employed (Figures 2 and 17) and under normal conditions it will run continuously during the casting of a plurality of plates. It is driven by a motor 297 carried on a bracket 298 supported from the back 32 by bolts 299. Coiled springs 301 are positioned between the heads of the bolts 299 and the bracket 298, to provide a resilient mounting for the motor and pump. A housing 302 for a shaft 303 extends from the motor 297 to the pump 296, and at its lower end carries a bearing 304 for the lower end of the vertically positioned shaft 303. An impeller 306, secured to the end of the shaft by a key 307 operates in a pump housing, which has an inlet 308 and a flanged outlet 309, a flanged elbow 311, and a pipe 312 extends upward to a coupling 313. A butterfly valve 154, is positioned in the pipe, and, as shown in Figure 18, includes a disc 314 secured to a shaft 316 by bolts 317. One end of a rod 318 is clamped to the shaft 316 by a bolt 319, and the other end is pivotally secured to one end of an adjustable rod 153 that is pivotally connected to the center of a horizontal rod 152, which extends between the ends of levers 139*a* and 139*b* (Figures 1 and 2). The arms and levers function to partly close the valve 154 when the mold is unlocked, thus limiting the amount of molten

metal circulated by the pump, and reducing the current consumed by the pump motor 297.

From the coupling 313 a Y-shaped pipe 321 (Figure 5) having an inlet and two flanged outlets 322a and 322b, connects with the flanged openings 323a and 323b, located on a lower half 325 of a semi-circular spout 324, that is provided with an open duct 326. The lower half 325 of the spout is also provided with flanged outlets 327a and 327b from which depends a U-shaped relief valve housing 328 having two flanged openings 329a and 329b secured to the two outlet ports 327a and 327b by bolts 331. A housing base 332 is secured to the bottom of the housing 328 by bolts 333, and at its lowermost point is provided with a discharge outlet 334 to which a return pipe 336 is attached, and has its lower or discharge end located below the surface of the metal within the melting pot 292. By the arrangement described, metal is circulated from below the surface of the molten metal and thus dross is not carried into the ducts or the mold.

The yoke 118 is provided with holes 337a and 337b (Figure 3) which receives a pin 338 secured by set screws 339. The pin 338 supports a hollow spring retainer 341 that is internally threaded to receive a plug 342. The plug forms an abutment for a coiled compression spring 343, which resiliently supports a head 344 of a stem 346, the lower end of which protrudes downward through a hole 347 in the plug 342, and through a hole 348 in an upper portion of the housing 328. A nut 349 screwed on the bottom of the stem 346 supports a yoke 351, the outer ends of which have holes 352 that receive the lower ends of valve stems 353a and 353b, each provided with a shoulder 354 and a nut 356. Valves 357a and 357b or other means of obstruction, each having a frustro-conical portion 358, are secured to the upper ends of the stems 353 by pins 359. The frustro-conical portion of the valves are lifted into engagement with valve seats 361, as shown in Figures 3 and 4, when the yoke 118 is raised to lock the mold. Thus closing the valves 357a and 357b, stops the flow of hot metal to the return pipe 336 and forces it into the mold, but when the yoke 118 is lowered, to unlock the mold, the valves open and permit free circulation of molten metal from the pump 296 to the spout 324, and back to the pot 292 by way of the pipe 336.

A semi-circular upper portion 362 of the spout 324 is secured to the lower portion 325 by bolts 363 (Figures 4, 5, and 6), and is provided with a plurality of upwardly facing arcuate openings or ports 364, through which metal may flow to enter the bottom of the casting chamber 31 by way of the gates 193 hereinbefore described. The upper portion 362 of the spout 324 has two radial lugs 366 (Figure 5) with vertical holes 367, and a lug 368 with an open sided hole 369. The lugs 366 and 368 receive stud bolts 371, which are screwed into the bottom of the back 32, and thereby support the spout 324. The external diameter of shanks 372 on the bolts 371 is less than the internal diameter of the holes 367 and 369, and the axial length of the shank 372 is greater than the thickness of the lugs. Thus, limited vertical and horizontal movements of the spout 324 with respect to the back 32 is permitted. When the mold is locked as shown in Figure 24C, the yoke 118 is raised to the position shown in Figure 4, the heads 127 engage the bottom or lower half 325 of the spout, and the springs 131 press the upper portion 362 of the spout against the tail plate 189 (Figure 6A) with the arcuate openings 364 aligned with the gates 193 in the tail gauge.

When the mold is fully closed and locked, the butterfly valve 154 will be open, the valves 357a and 357b will be closed, and the metal pump 296 will force molten metal through the spout 324 and into the mold until it is filled, at which time the pressure of the metal on the top of the valves 357a and 357b will overcome the spring 343 and force the valves open, permitting the excess metal to return to the pot 292 through the pipe 336.

From Figure 2, it will be seen that the metal pot 292 is supplied with a flanged portion 373 and if molten metal accidentally leaks from any parts of the metal circulating system or from the mold 31, it will fall into the pot.

The thermostat bulb 293 (Figures 2 and 17), responds to the temperature of the metal in the pot 292, and when the metal is at the correct temperature, it closes a switch 374 (Figure 21), the function of which will be described hereinafter.

Cooling

Means for cooling the metal in the mold after the mold is full, includes a plurality of water pockets 376 and 377 (Figure 6) in the back 32 and the core 33 respectively through which water is circulated through pipe connections not shown. A solenoid operated water valve 378 (Figure 21) governs the flow of water through the water pockets, as well as through another water pocket 379 (Figures 6 and 6A) which is located near the tail gauge 191. Cooling water is carried to and from this pocket through pipes 380, one of which is shown in Figure 6. A thermostat bulb 446 for operating a switch 447 is located in the pocket 376 (Figure 6), and a second thermostat bulb 448 (Figure 6A) for operating a switch 449 is located near the pocket 379.

Plate discharge

When the core 33 is in the approximately horizontal position shown in Figure 24F, plate receiving arms 381a and 381b (Figures 1 and 2) engage opposite sides of the plate P, lift it from the core 33, and later deposit it on rollers 382a and 382b of an inclined conveyor 383. Since arms 381a and 381b are similar, only one will be described. The arm 381a pivotally supported from the side frame 30a on a stud 384a, has a number of lugs 386, and a plate stop 387 for supporting and engaging the plate P. A link 388a, pivotally connected at one end to the arm 381a by a pin 389a has its other end pivotally connected to one end of the lever 92a by a pin 391a. The lever 92a is pivotally supported from a lug 392 formed as part of the housing 59 hereinbefore mentioned. The roller 91a is rotatably supported midway of the ends of the lever 92a, and engages the cam 89a formed by the periphery of the crank plate 54A. A limit switch 393 mounted on a portion of the conveyor 383 has an operating arm 394 that is depressed whenever a plate P is in the position shown by lower dotted lines in Figure 2, and by solid lines in Figure 24F. Such operation of the switch 393 prevents operation of the main motor 86 should a newly deposited plate fail to move down the conveyor 383.

Timer

An instantaneous reset timer 400, arranged to open and close a plurality of electrical circuits for automatically controlling the casting operation, is shown in Figure 23, and includes a

synchronous motor 401 for driving a worm 402, and a worm wheel 403 secured to a shaft 406, the other end of which carries one member of a magnetic clutch 407. The other member of the clutch 407 is secured to a shaft 408 on which are mounted switch operating cam discs 411, 412, 413, 414, 415 and 416, for operating switches 421, 422, 423, 424, 425, and 426 respectively. The clutch 407 and motor 401 are energized from the same electric circuit, and thus the clutch is closed whenever the motor 401 is operated. A spring 417 returns the shaft 408 and its discs to the starting position shown in Figure 23, whenever the clutch is deenergized. Switches 423 and 424 are normally closed when the timer is in the reset position, and the switches 421, 422, 425 and 426 are normally open.

Switches and relays

A number of other items, shown only in Figure 21, are provided in order that the casting machine may operate automatically. These include: A stop-run switch 427, which must be closed before the machine can be operated, and may be used in an emergency for stopping the machine at any point in its cycle of operation by cutting off all current supplied to it; a pump button 428 for starting the metal pump; a metal pump relay having a solenoid 430 and four normally-open switches 431, 432, 433 and 434; a resetting relay having a solenoid 440 and three normally-open switches 441, 442 and 443; a main control-relay having a solenoid 450 and two normally-open switches 451 and 452; a single-continuous switch 436, which when open causes the casting machine to be shut down after each plate has been cast, and when closed causes the casting machine to continue casting plates; a three-point cast button 437 for starting the casting operation; a plate-interlock relay having a solenoid 460 and two normally-open switches 461 and 462; a main motor-control-relay having a solenoid 470, one normally-closed switch 471 and two normally-open switches 472 and 473; a locking-motor control-relay having a solenoid 480 and two normally-open switches 481 and 482; and a vacuum-pump relay having a solenoid 490 and two normally-open switches 491 and 492.

The electrical connections are shown schematically in Figure 21. For simplification, some of the electrically operated switch contacts are shown associated with their operating coils but without connections, and again shown with connections at an appropriate place on the diagram. The same numerals identify the contacts in both places, and all switches are shown as positioned when the machine is in the starting position and all circuits deenergized.

Operation

Figure 24A shows the casting machine in the "starting" position. In this position the roller 71 (Figure 16) contacts the roller 72 of the limit switch 74 and closes the contact 81. If a matrix M is in place and the machine is ready for casting plates, the handles 236*a* and 236*b* will be open (Figure 8), the switches 249*a* and 249*b*, will be closed, and the lever 277 (Figure 1) on top of the mold will be down closing the switch 276. If the stereotype metal in the pot 292 is heated to the proper temperature, the thermostat switch 374 (Figure 2) will be closed and the switches of deenergized timer 400 (Figure 23) will be in the position shown in Figure 21. Since the mold is unlocked, the cam 104 (Figures 2 and 15) engages the switch 106 and holds the contact 111 open and the contact 109 closed. The cam 107 (Figure 15) is in the "down" position, but has passed its point of engagement with the switch 108, so the contact 112 is closed and the contact 113 open. With no plate on the conveyor 383, the switch 393 is closed.

If a matrix is not in place, one can be inserted by lifting the lever 277 and closing the handles 236*a* and 236*b* (Figure 7). This procedure opens the jaws 233*a* and 233*b*, and opens the safety switches 276, 249*a* and 249*b* making it impossible to start the casting operation. After the matrix has been positioned between the jaws, the lever 277 is swung downward closing the switch 276, and the handles 236*a* and 236*b* are opened, thereby closing the matrix jaws and the switches 249*a* and 249*b*.

When the stop-run switch 427 is closed, the solenoid 440 of the reset relay is energized by a circuit extending from the line L—1 through a conductor 453, the switches 276, 249*a* and 249*b*, a conductor 454, the contact 81, a conductor 456, the solenoid 440, a conductor 457, the closed switch 423 and through the thermostat 374 to the line L—2. Energizing the solenoid 440 closes the switch 441 and establishes a maintaining circuit for the solenoid 440, that extends from the line L—1 through a branch of the conductor 453, through the switch 441 and thence through conductor 457, switches 423 and 374 to the line L—2. Energizing the solenoid 440 closes the switch 442 and prepares circuits for starting the metal pump motor 297 by the push button 428. Closing the push button 428 energizes the solenoid 430 of the metal pump relay by establishing a circuit that extends from the line L—1, through the switch 427, the push button 428, through the solenoid 430, and thence through the switches 442, 423 and 374 to the line L—2. Energizing the solenoid 430 closes a switch 431 to establish a maintaining circuit that short circuits the pump push button 428, and also closes the switches 432 and 433 that energizes the pump motor 297 from the lines L—1, L—2 and L—3. Provided the control equipment functions properly, the metal pump will run continuously and circulate metal from the pot 292 through the duct 326, past the valves 357*a*—357*b*, and back to the pot by means of the pipe 336. If the metal pump should stop during the casting operation, it can not be started again except when the core 33 is in the starting position shown in Figure 24A.

If it is desired to cast only one stereotype plate the single-continuous switch 436 is opened. However, if more than one stereotype plate is required, the switch 436 is closed to the continuous position. This establishes a circuit in parallel with the contact 79 of the limit-switch 74, and thus nullifies the opening of the contact 79 which occurs every time the casting mold passes through the starting position. A casting cycle of operation is started by pressing the casting button 437. This completes a circuit through the solenoid 450 of the main control relay, extending from the line L—1, through the switch 427, conductor 453, the switches 276, 249*a* and 249*b*, the casting button 437, conductor 458, the solenoid 450, and thence to the line L—2. Closing the casting-switch 437 also energizes the solenoid 460 of the plate-interlock-relay by a circuit that extends from the central contact of the casting switch 437, through a conductor 459, the solenoid 460, and thence to the line L—2. If no plate P is on the conveyor 383, and the contact 112 of the limit-switch 108 is closed, a maintaining cir-

cuit will be established for solenoid 460. This circuit extends from the line L—1, through the switch 427, conductor 453, switch 452 (then closed), through the switch 397, or through the contact 112, to a conductor 465, switch 461, the solenoid 460, and thence to line L—2.

The simultaneous energization of the solenoid 450 and the solenoid 460 starts the main motor 86 by establishing a circuit through the contact 82. This circuit extends from the line L—1 through switch 427, conductor 453, switch 452, through contact 82, a conductor 463, switch 462, solenoid 470 and thence to line L—2. Energizing the solenoid 470, closes switches 472 and 473 to connect the main motor 86 to the lines L—1, L—2 and L—3.

As the main motor 86 turns, the worm 84 and the worm wheel 64 rotate the crank plates 54 (*a*) and 54 (*b*) in a counterclockwise direction, as seen in Figure 2, to move the arms 38*a* and 38*b* and the core 33 from the position shown in Figure 24A toward the position shown in Figure 24B. As soon as the crank plates have moved a short distance, the roller 71 is disengaged from the limit-switch 74, which thereupon opens the contact 81 and closes the contact 79. This establishes a circuit that is in parallel with two of the contacts of the casting-button 437. The casting-button can now be released, because the contact 79 of the switch 74 will not be opened again until the casting machine has completed one complete operation and returned to the starting position. As the core 33 moves toward the closed position Figure 24B, the plates 234 (Figure 8) contact the pins 235 and move side gauges 218 to the position shown in Figure 9.

At this time, the roller 71 (Figures 2 and 16) engages the limit-switch 76 opening the contact 82 and closing the contact 83. Opening the former stops the main motor 86 by deenergizing the solenoid 470. Closing the latter starts the timer 400 (Figure 23) and the locking motor 96 (Figures 2 and 15). The timer is operated by the motor 401 and the clutch 407 from a circuit extending from line L—1 through switch 427, conductor 453, switch 452, contact 83, a conductor 464, the switch 443, the timer motor 401 and the clutch 407 in parallel, and thence to the line L—2. The locking motor is energized from a circuit extending from line L—1, through switch 427, conductor 453, switch 452, switch 76, contact 83, conductor 464, thermostat 449, a conductor 466, switch 471, the intitially closed timer switch 424, a conductor 467, and through solenoid 480 to the line L—2. Energizing the solenoid 480 closes the switches 481 and 482 and connects the locking motor 96 to the lines L—1, L—2 and L—3.

Starting of the timer (Figure 23) closes the switch 421 and starts the vacuum pump 283 through a circuit from the line L—1, through the switch 427, coductor 453, switch 452, contact 83, a branch of conductor 464, timer switch 421, and thence through the solenoid 490 to the line L—2. The solenoid 490 closes switches 491 and 492 to connect the motor 284 to lines L—1, L—2 and L—3, and drives the vacuum pump to exhaust the spaces 279 and 281, and pull the matrix against the back.

Immediately after the locking motor 96 (Figure 2) starts to lock the mold, the cam 104 (Figure 15) is disengaged from limit switch 106, opening contact 109 and closing contact 111. Closing the latter establishes a circuit, for the solenoid 480, around timer switches 422 and 424 which open shortly thereafter, but the solenoid 480 remains energized through the contact 111, and the locking motor 96 raises the rod 114 (Figure 2) moving the yoke 118 to the position shown in Figure 12 and thereby engages the rollers 133*a* and 133*b* with the lower cams 134*a* and 134*b*, and the upper cams 149*a* and 149*b* with the rollers 151 and 151*b*, completing the locking movement. When the locking mechanism reaches the fully closed or locked position (Figure 24C), a cam 105 operates the switch 106, opens the contact 111 and closes the contact 109. Opening the former, deenergizes the solenoid 480 and stops the locking motor 96, while closing the latter partially completes a circuit to the water-valve solenoid 378.

When the core 33 reaches the fully closed or locked position (Figure 24C) the cam bracket 261 (Figure 9) engages the roller 263 releasing the grip of the jaws 233 on the matrix M. When released, the matrix, guided by pins 286, is pulled against the back 32 by the suction of the vacuum pump. The bellows 288 is simultaneously exhausted, and the switch 287 thereby closed, short circuiting the switch 423 of the timer.

While the mold was being locked, the timer continued to operate and after a predetermined period it opens timer switch 423. If the matrix has not been positioned before the timer switch 423 opens, the metal-pump motor 297 will stop and cannot be started until the core 33 is moved to the "starting" position (Figure 24A). After the timer switch 423 has remained open for a certain time, it is again closed by continued operation of the timer, closure occurring before the switch 421 is opened by the cam 411. Soon after the switch 421 closes, the switch 422 closes re-establishing the main circuit to the solenoid 480.

When the yoke 118 is raised by the mold locking mechanism, the springs 131 (Figure 12) press the spout 324 against the bottom of the core 33, and align the ports 364 with the gates 193 (Figure 6A). Raising of the yoke 118 operates the arms 153 and 318 to open the butterfly valve 154, and simultaneously raises the yoke 351 and the by-pass valves 357*a* and 357*b*. The metal pump 296 then forces molten metal through the spout 324, the port 364, the gates 193 and into the casting chamber 31. When the casting chamber is full, the pressure of the metal against the tops of the valves 357*a* and 357*b* forces them to open against the pressure of the spring 343, and thus to by-pass the excess metal. However, the pump continues to exert pressure on the metal in the casting chamber.

At this time, the timer switch 425 closes making a connection in the circuit of the solenoid operated valve 378, and if the thermostat switch 447 is closed, cooling water will flow through the water pockets 376 and 377 in the mold members 34 and 33, but should the mold be too hot the thermostat will prevent opening the solenoid valve 378.

The circuit for the solenoid valve extends from the line L—1, through the switch 427, conductor 453, switch 452, contact 83, conductor 464, contact 109, switch 425, valve solenoid 378, and through the thermostat switch 447 to the line L—2. After the cooling water has been flowing long enough to cool the plate P and solidify the tail T, the timer switch 425 opens and stops the flow of cooling water. At this time the thermostat switch 449 will have closed, and closing of the timer switch 426 energizes the motor 96 to start unlocking the mold, by moving the parts toward the position shown in Figure 24D. The

circuit that energizes the motor 96 includes the contact 83, conductor 464, thermostat switch 449, switch 426, and the solenoid 480. If the temperature at the bulb 446 is too high to indicate solidification of the tails T, the switch 449 will be open, and the motor 96 will not unlock the mold until the tails solidify. The cams of the timer 400 are preferably made adjustable so adjustments of timing may be made if desired.

Shortly after the motor 96 starts to unlock the mold, the cam 105 (Figure 15) is disengaged from the limit switch 106 closing contact 111 which parallels the switches 449 and 426 in circuit with the locking motor 96. Soon thereafter, the timer switch 426 opens leaving the solenoid 480 for the locking motor 96 under control of the switch 106. When the unlocking movement is almost completed, the cam 107 engages the limit switch 108 (Figure 15) for a short time. This opens contact 112 and closes contact 113. Opening the former has no effect, provided a newly cast plate is not on the conveyor, but closing the latter starts the main motor 86 by a circuit that can be traced from the line L—1, through switch 427, conductor 453, switch 452, contact 113, switch 462 and through the solenoid 470 to the line L—2. For a short time both the main and the locking motors run together until the cam 104 opens the contact 111, deenergizing the solenoid 480 and stopping the locking motor 96.

Operating the locking mechanism from the locked position (Figure 24C) to the unlocked position (Figure 24D), lowers the yoke 118 and thereby unlocks the top and bottom of the mold. Lowering the yoke separates the spout 324 from contact with the mold, opens the by-pass valves 357*a* and 357*b*, and closes the butterfly valve 154.

If a previously cast plate is on the conveyor 383 and engaging the switch 393 (Figure 2) at the time the contact 112 opens, the solenoid 460 will be deenergized to stop the main motor 86. When such plate is removed from the conveyor, the switch 393 closes, and operation may be resumed by pressing the cast button 437 energizing the solenoid 460 and starting the motor 86.

As the core 33 and the newly cast plate are withdrawn from the back 32, the side gauges 218 are swung open by the spring pressed plungers 219. This operation strips the matrix from the newly cast plate in a known manner, and as the main motor continues to operate the core is moved from the position shown in Figure 24D, through the position shown in Figure 24E, to the position shown in Figure 24F. It will be noted that the arms 38*a* and 38*b*, in combination with the links 47*a* and 47*b*, move the core 33 and the plate P from the vertical casting position to the approximately horizontal discharge position shown in Figure 24F. As the core and plate are swung and turned by this movement, the straight edges of the newly cast plate engage the lugs 386 on the arms 381*a* and 381*b*, which separate the plate from the core. The top of the plate P which in this position is pointed downward on the conveyor, engages stops 387 (Figure 2), and thus is held by the arms 381*a* and 381*b*. As the crank plates 54*a* and 54*b* continue to rotate, high portions of the cams 89*a* and 89*b* operate the cam rollers 91*a* and 91*b* to raise the arms 92*a*—92*b*, the links 388*a*—388*b*, and arms 381*a*—381*b*, lifting the plate P out of the path of travel of the core 33, as it returns to the "starting" position by the continued rotation of the crank plates. As soon as the core has cleared the plate (Figure 24G), the arms 381*a*—381*b* are lowered to slightly below the position shown by solid lines in Figures 2 and 24A. This disengages the stops 387 from the plate and allows it to run down the conveyor 383, which may carry it to a finishing machine, not shown.

If the single-cointinuous switch 436 is open, the core 33 is stopped in the "starting" position (Figure 24A), when the roller 71 engages the switch 74 and opens the contact 79, but if the single-continuous switch is closed, the core continues its movement to the closed position (Figure 24B), and the cycle hereinbefore described will be repeated.

It will be understood that by the use of any suitable switch mechanism, actuated by a counting device that can be set to cut off the current supplied to the machine after any predetermined number of plates have been cast, the machine may be started by the operator, and casting will continue without further attention until the desired number of plates are made.

A modified form of the plate discharge mechanism is shown in Figure 25. This, like the previously described form has corresponding front and back members and such members on only one side will be described. The device includes a crank plate 494 provided with a steep slope 495, that cooperates with a roller 496 carried at the ends of an arm 497, formed integral with an arm 498, and constituting a bell crank arrangement which is pivotally mounted on a stud 499. The arm 498 is pivotally secured to one end of a rod 501 by a pin 502, and the other end of the rod 501 is pivotally secured to a pusher member 503 by a pin 504. The pusher 503 is pivotally supported from the side frame 30 by a stud 505, and the whole mechanism is biased by a spring 506, carried by a rod 507 pivotally connected to the arm 498 by a pin 508, the rod being supported in a hole 509 in a poppet 511. When the roller 496 runs down the slope 495, the spring 506 causes the member 503 to push the plate P, and start it rolling down the incline of the conveyor 383.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiment be considered in all respects as illustrative and not restrictive, reference being made to the claims rather than to the foregoing description for an indication of the scope of the invention.

What I claim is:

1. In a stereotype plate casting machine having a back and core arranged to form a closed casting chamber and a melting pot, and in combination, a duct leading from and returning to the melting pot, means for maintaining a continuous circulation of metal through the duct comprising a continuously operable rotary pump in the melting pot for supplying metal thereto, the casting chamber having a port opening directly off the duct for filling the chamber from metal therein, and a valve for obstructing the return through the duct, whereby the pressure in the duct adjacent the port may be raised to force the metal into the casting chamber.

2. The combination according to claim 1, comprising also a valve for obstructing the duct leading to the port for reducing the circulation when the casting chamber is open.

WILLIAM F. HUCK.

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