Feb. 9, 1954

W. A. BARKER

APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

2,668,384

Filed Aug. 5, 1950

15 Sheets-Sheet 1

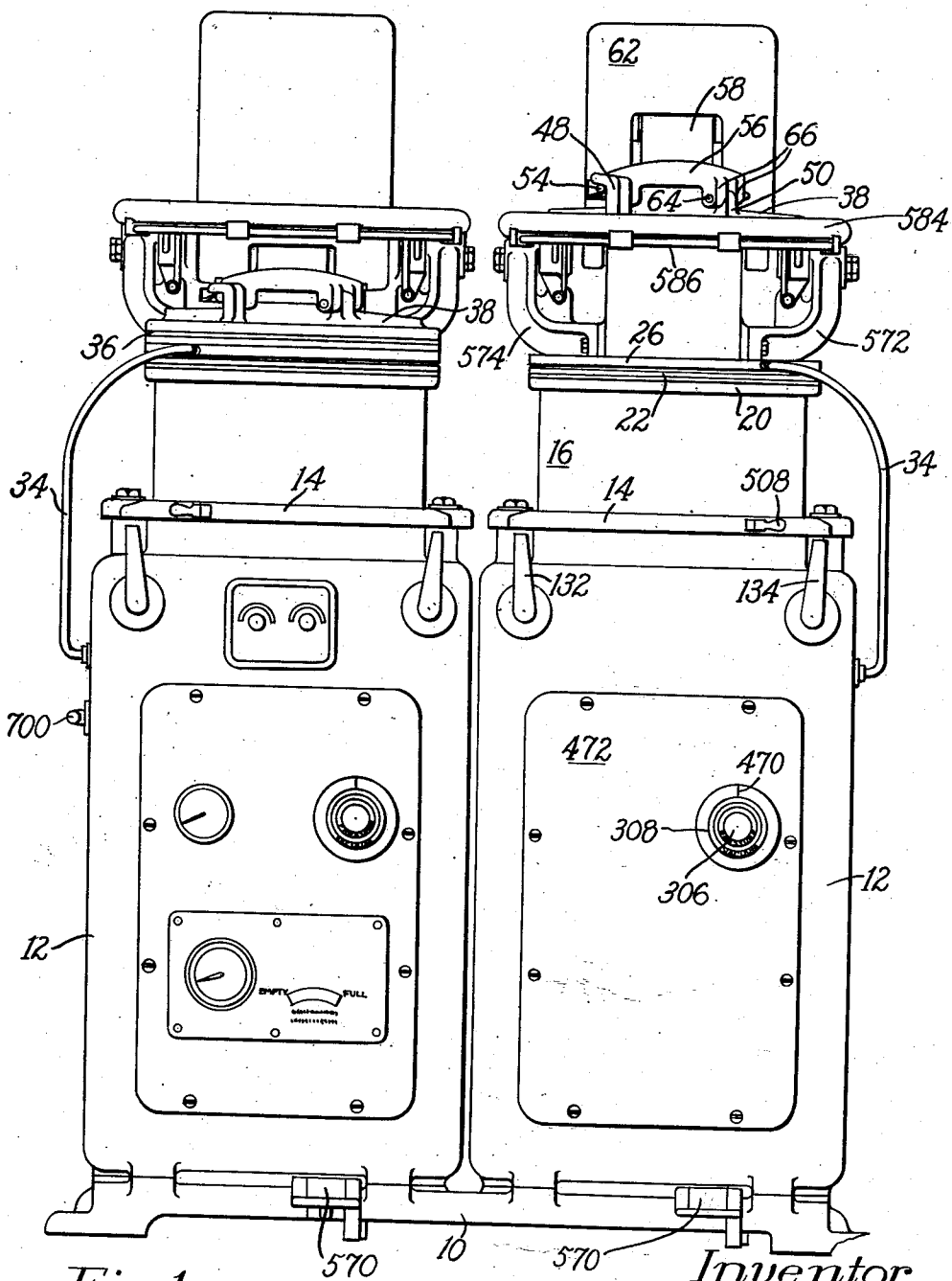

Fig. 1

Inventor

William A Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

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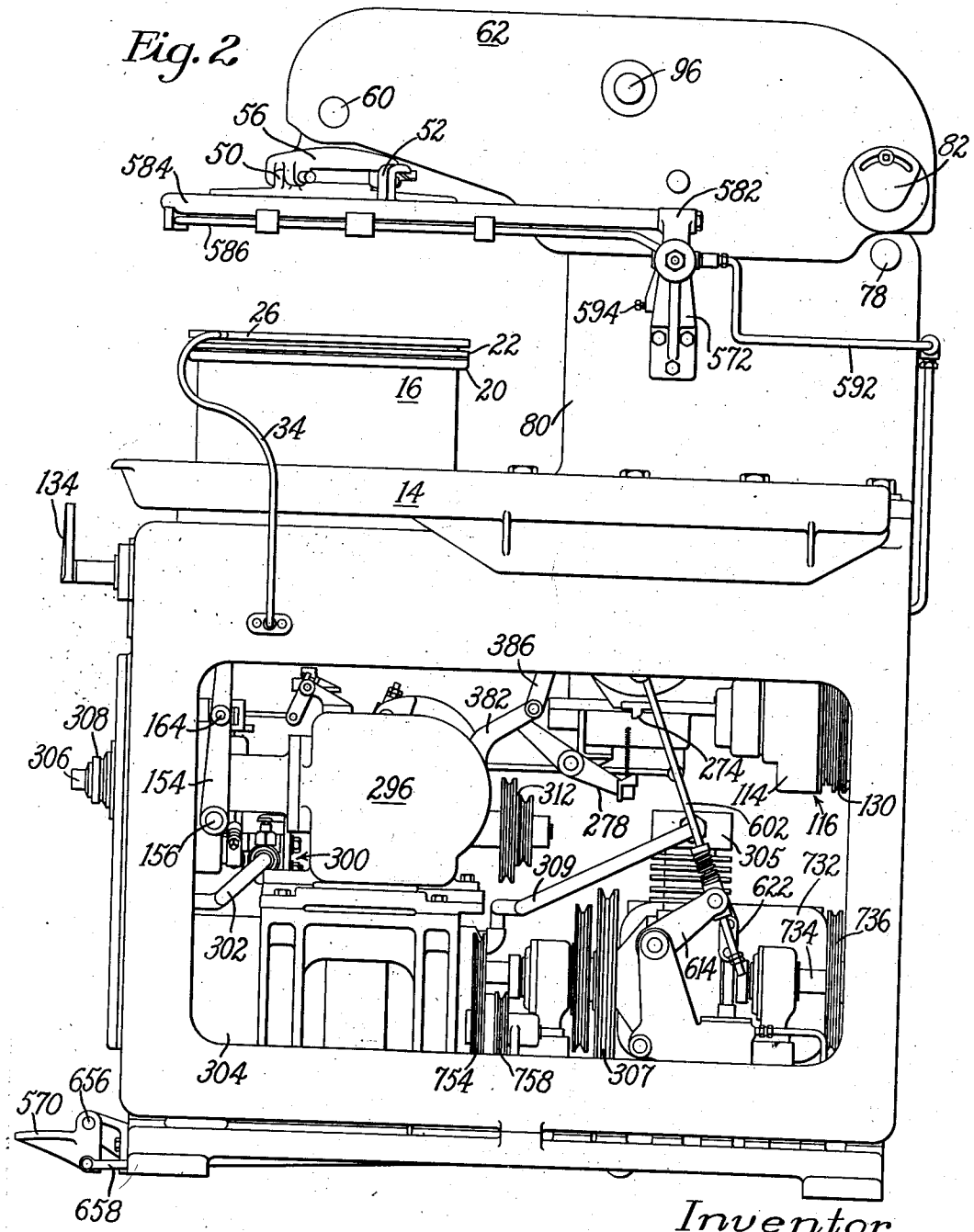
15 Sheets-Sheet 2

Fig. 2



Inventor

William A. Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

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15 Sheets-Sheet 3

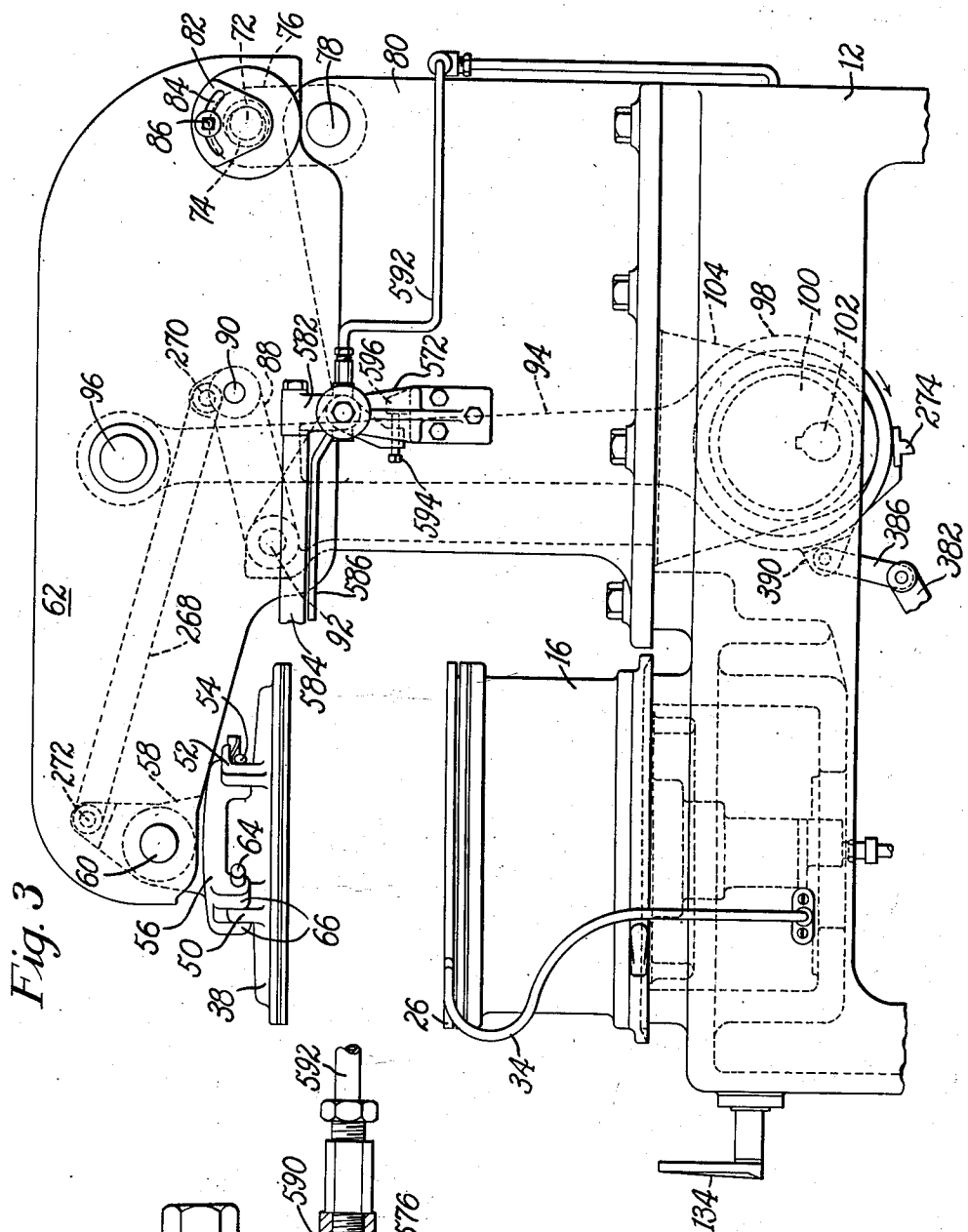

Fig. 3

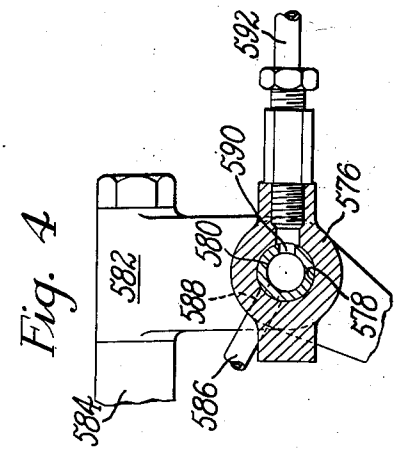

Fig. 4

Inventor

William A. Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

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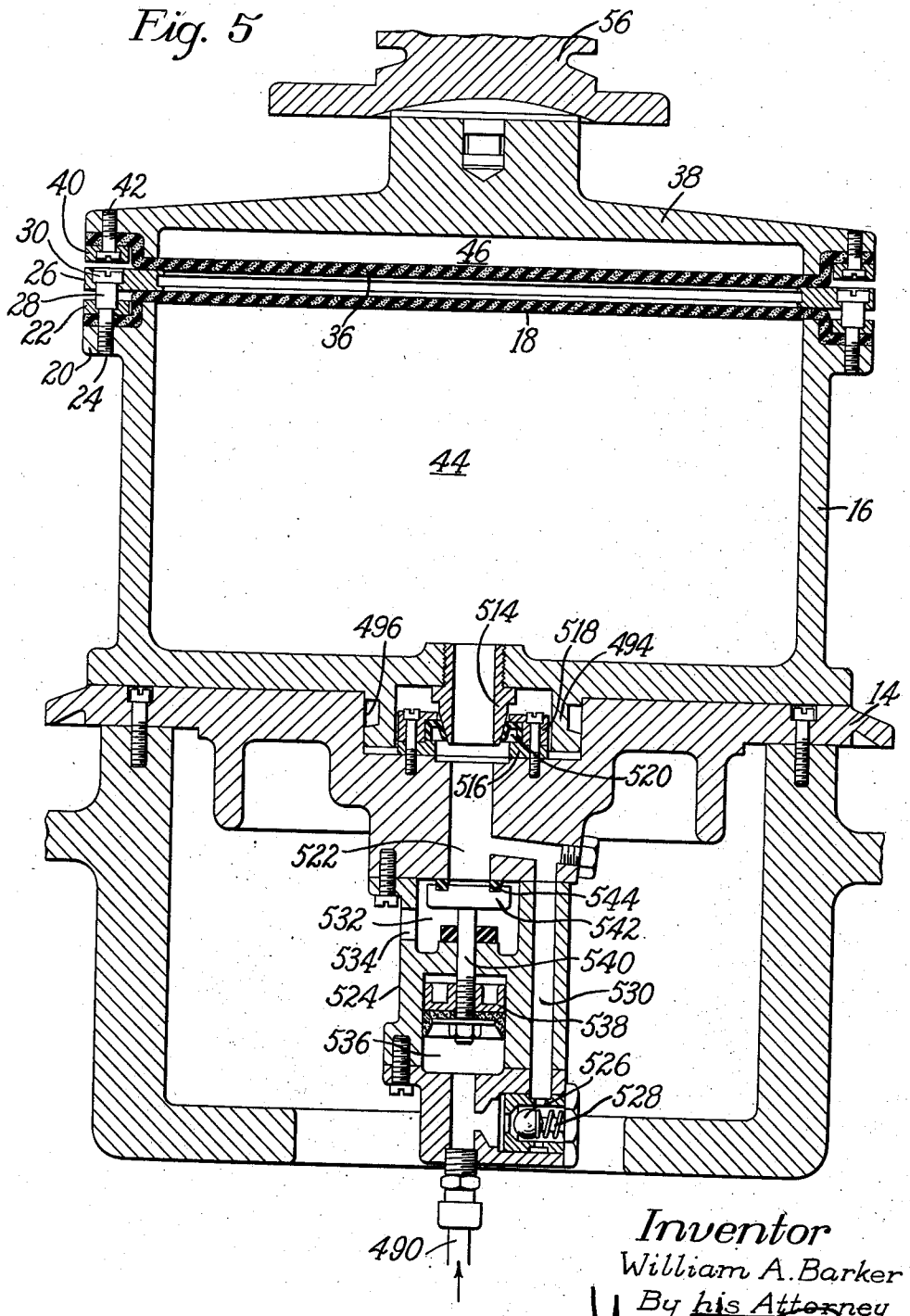
Fig. 5



Inventor

William A. Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

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Fig. 6

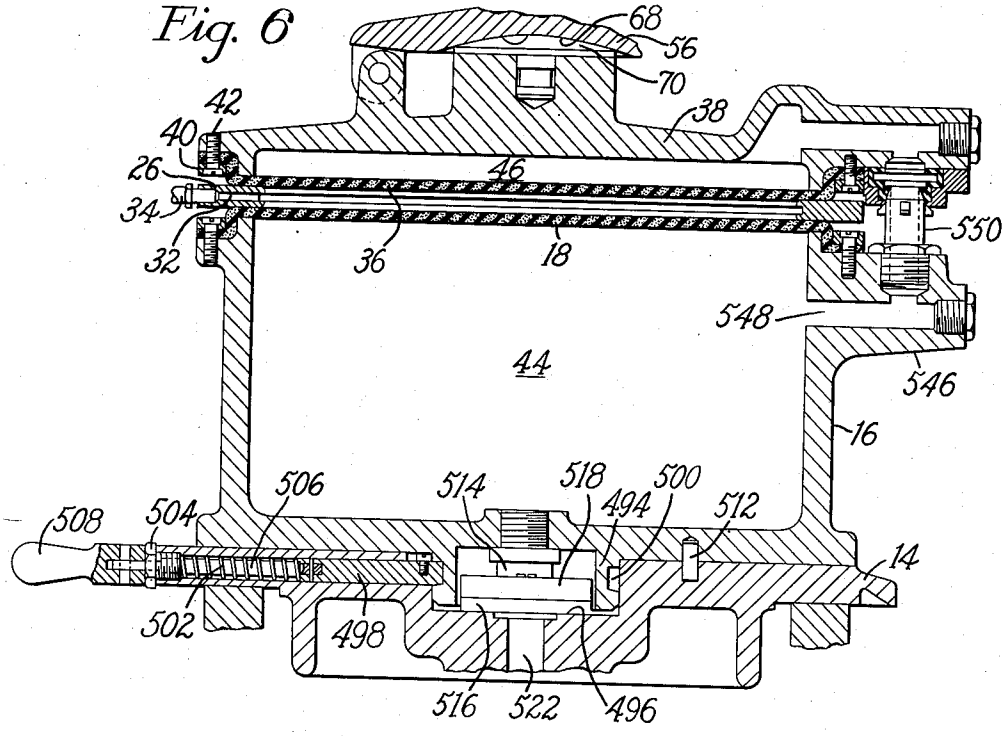


Fig. 7

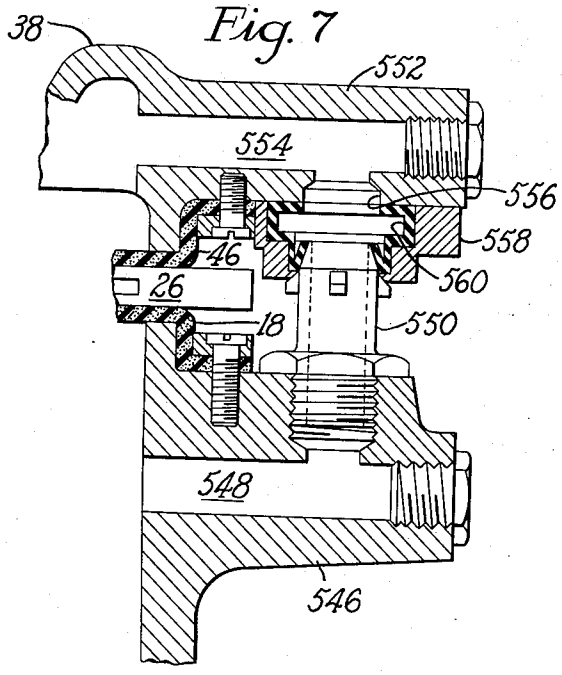
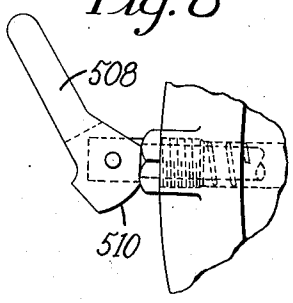


Fig. 8



Inventor

William A. Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

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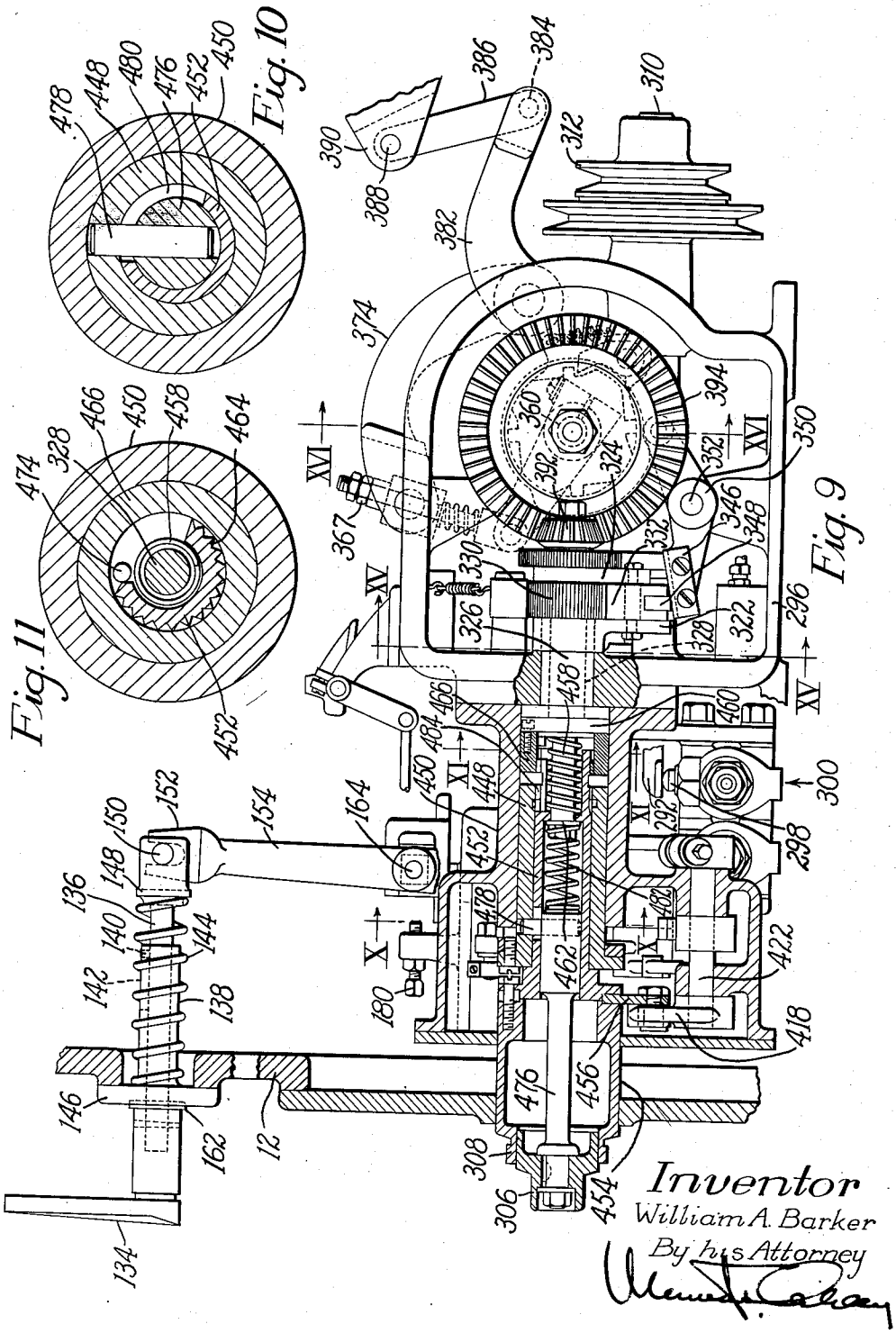

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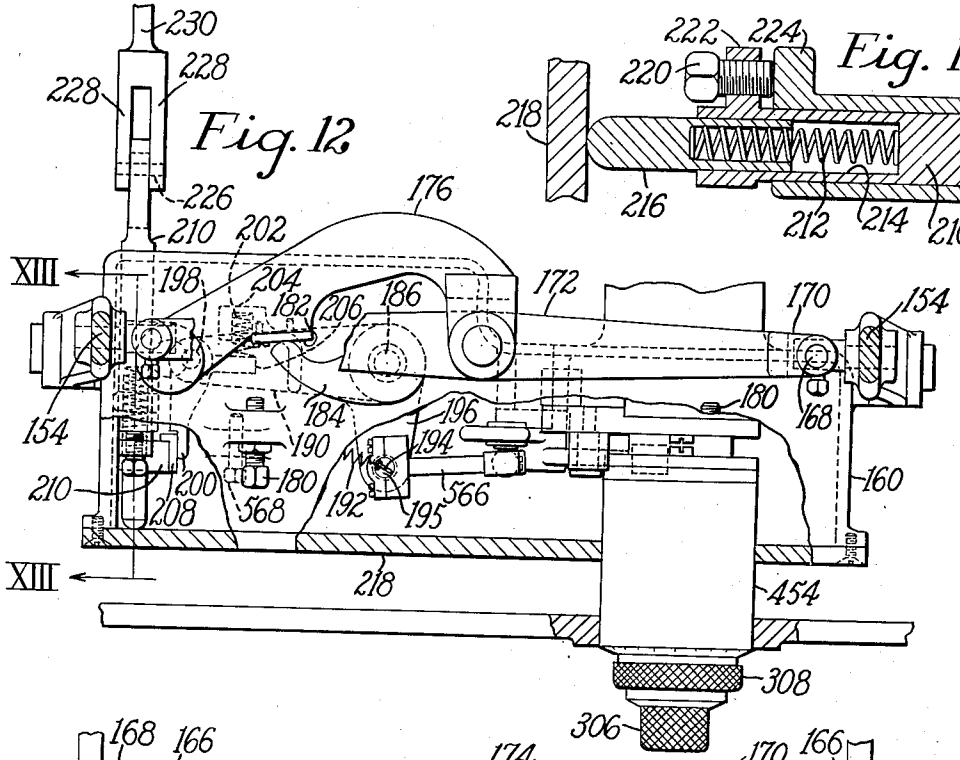

Fig. 12

Fig. 13

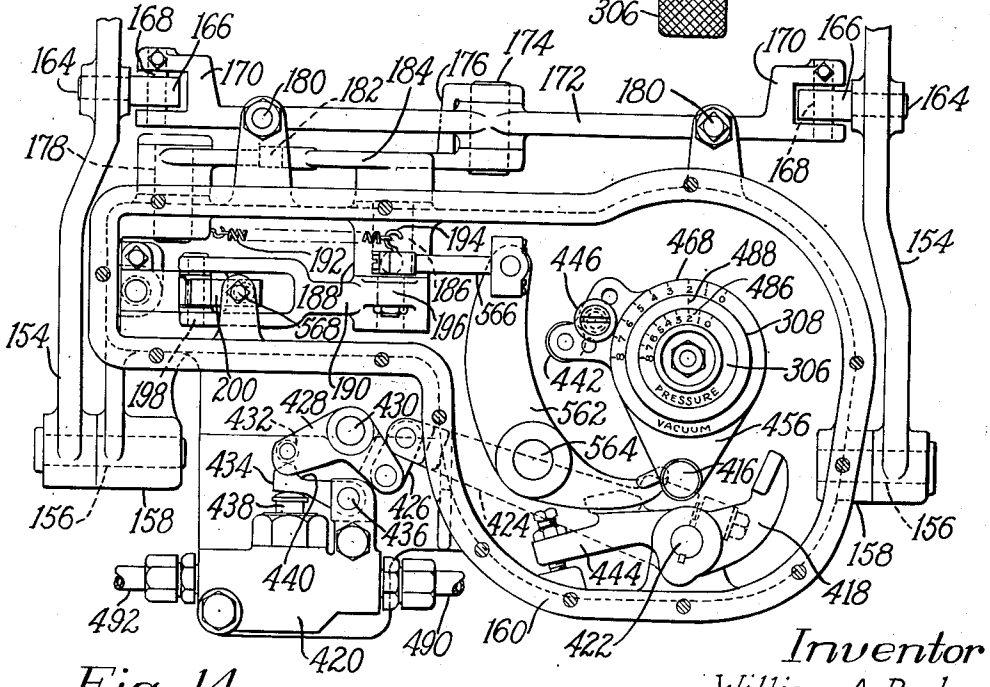

Fig. 14

Inventor

William A. Barker

By his Attorney

Feb. 9, 1954

W. A. BARKER

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Fig. 16

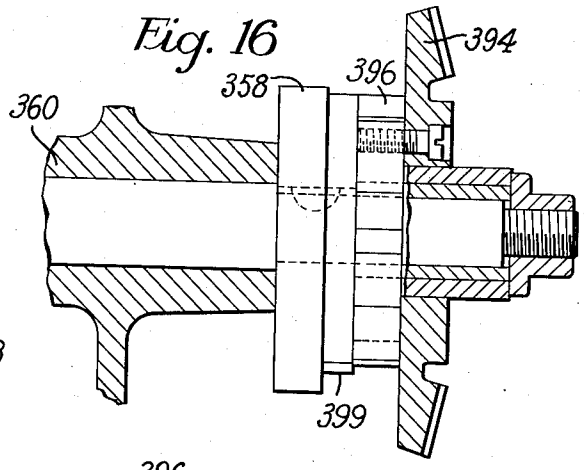
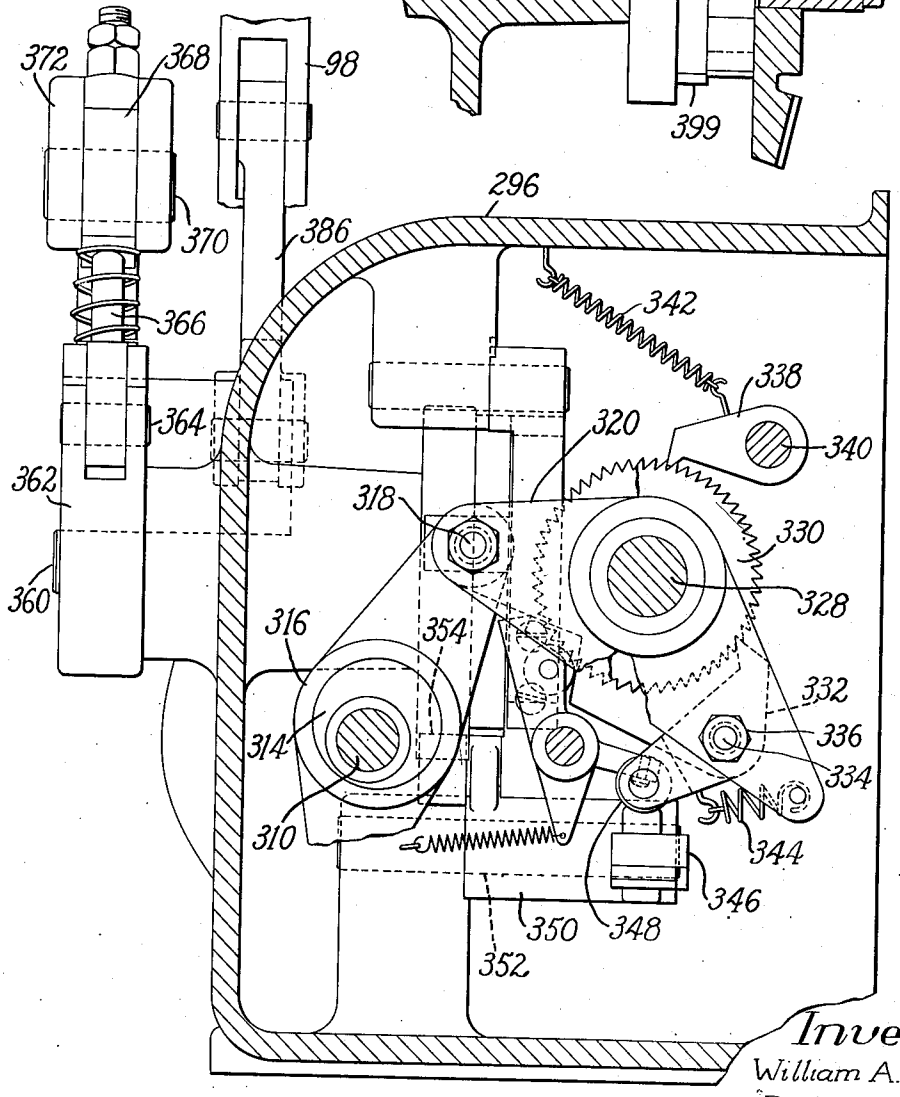


Fig. 15



Inventor

William A. Barker

By his Attorney

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APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

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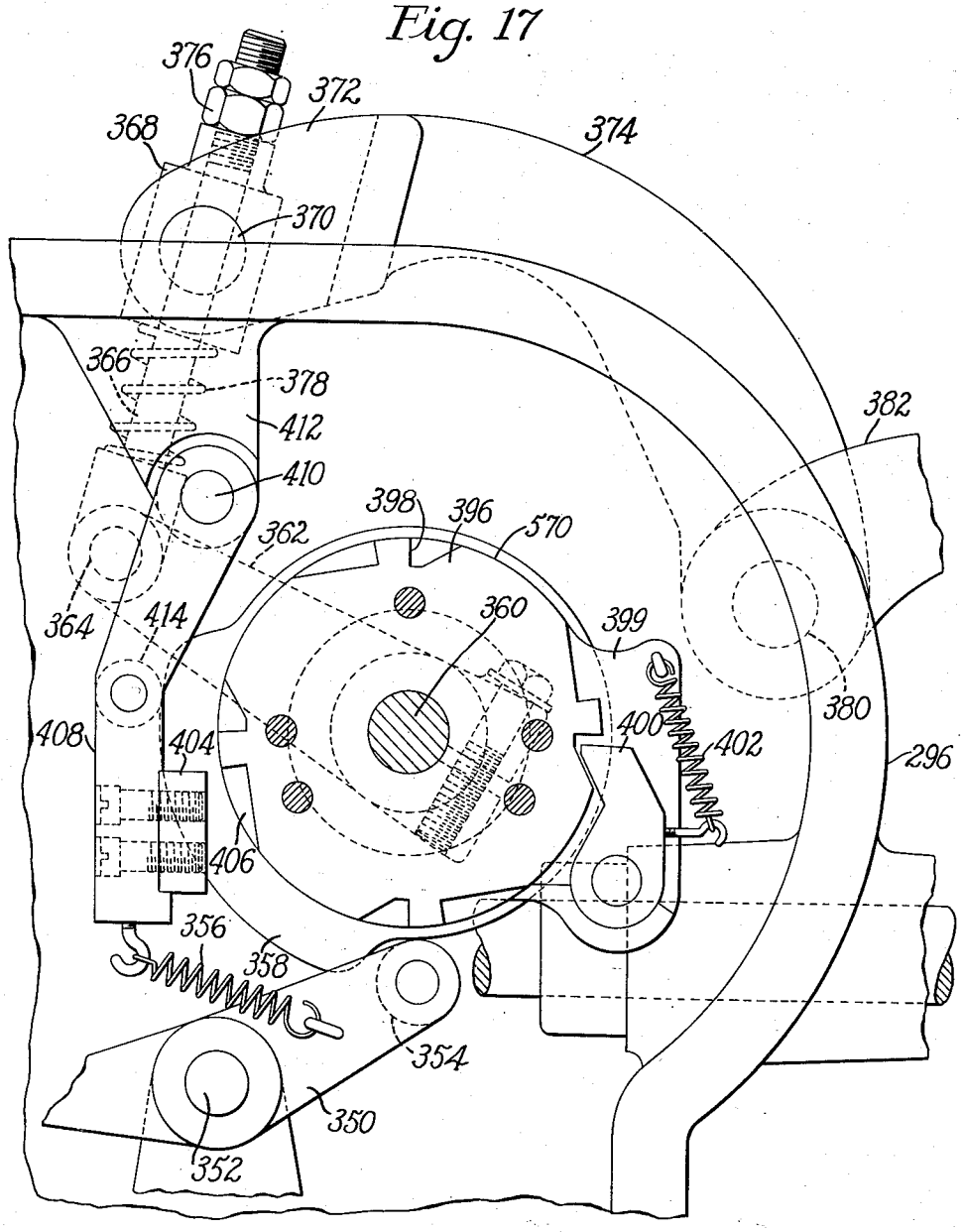
Fig. 17



Inventor
William A. Barker
By his Attorney

Feb. 9, 1954

W. A. BARKER

APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

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Fig. 18

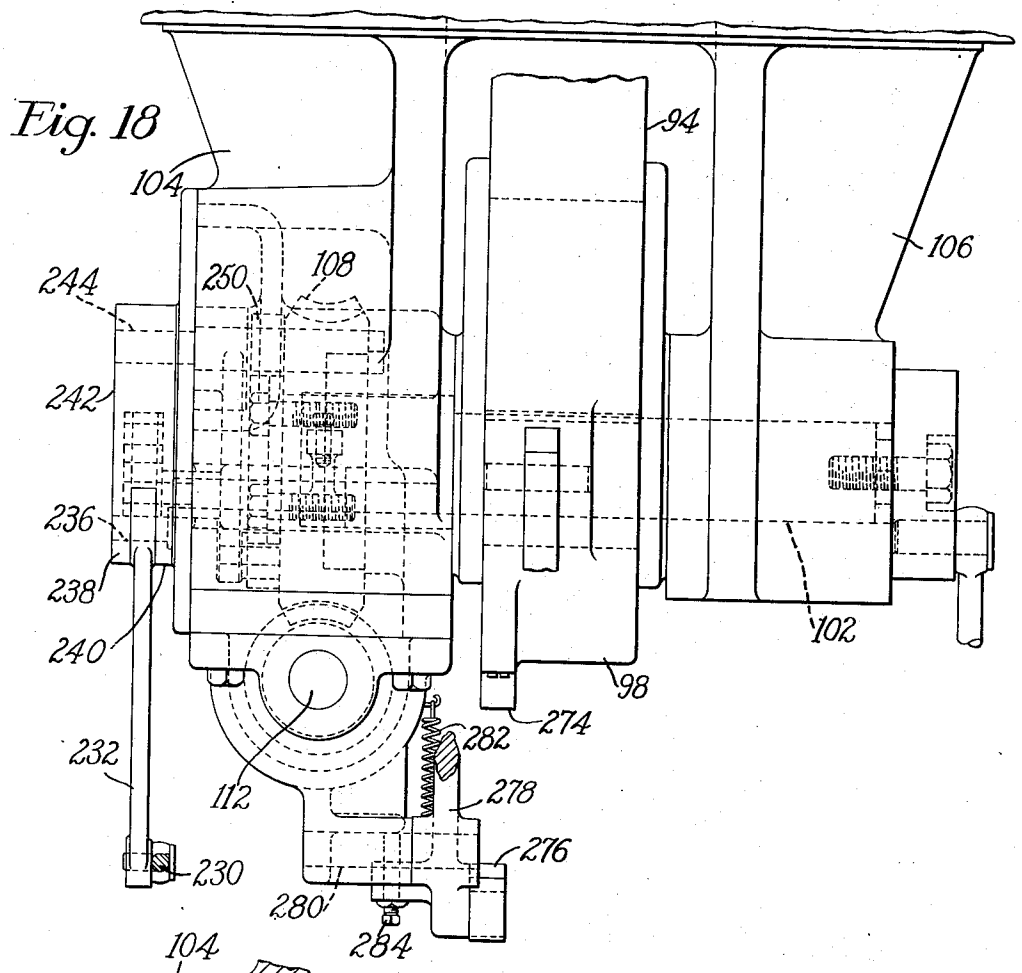
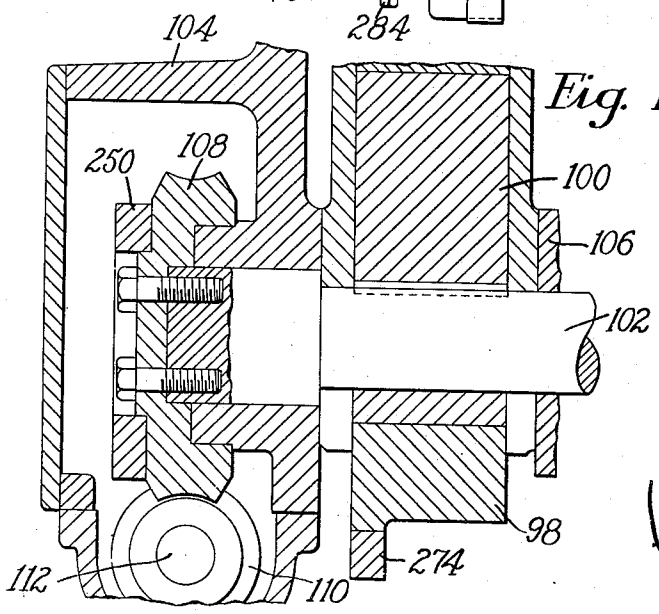


Fig. 19



Inventor

William A. Barker

By his Attorney

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APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

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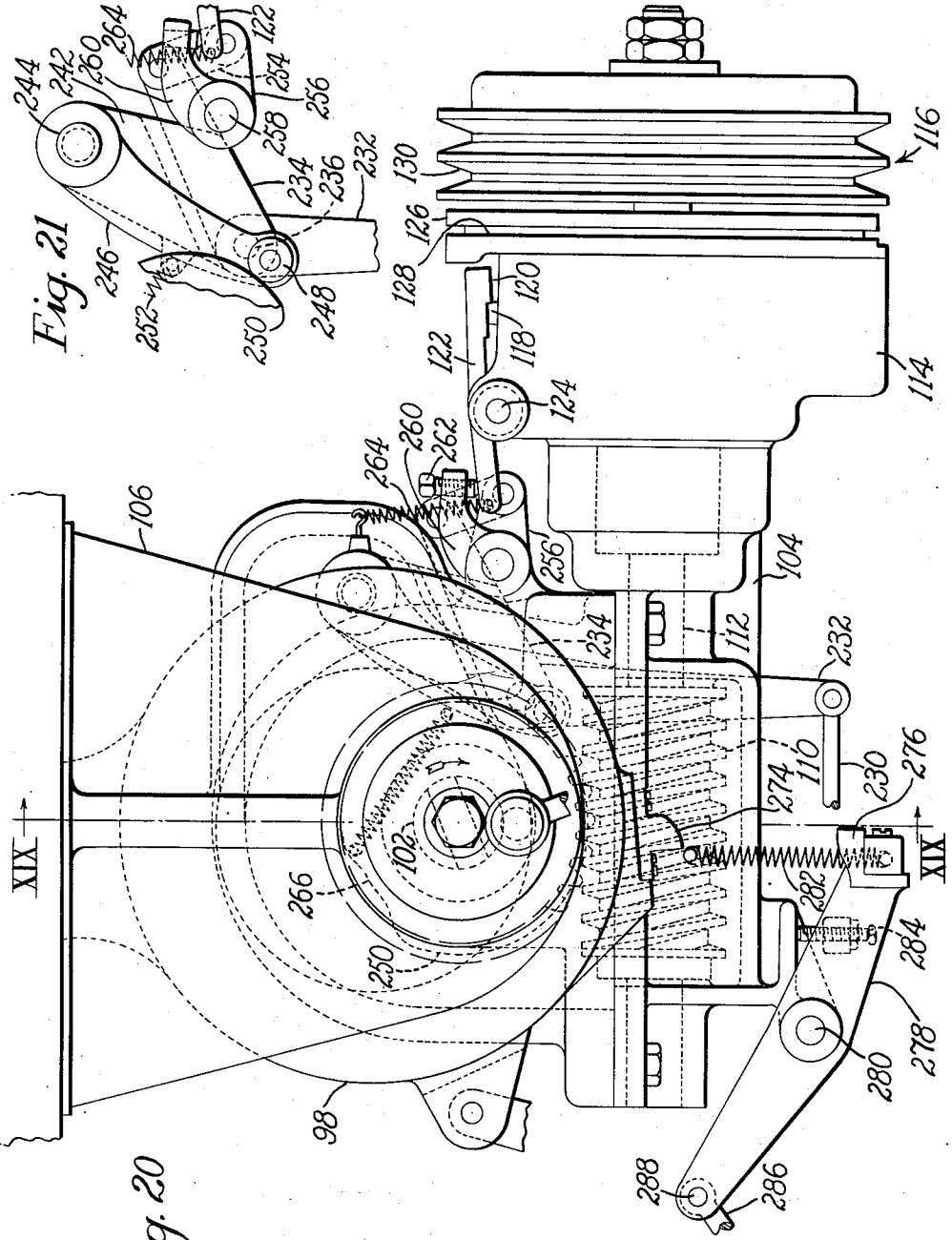

Fig. 21

Fig. 20

Inventor
William A. Barker
By his Attorney

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15 Sheets-Sheet 12

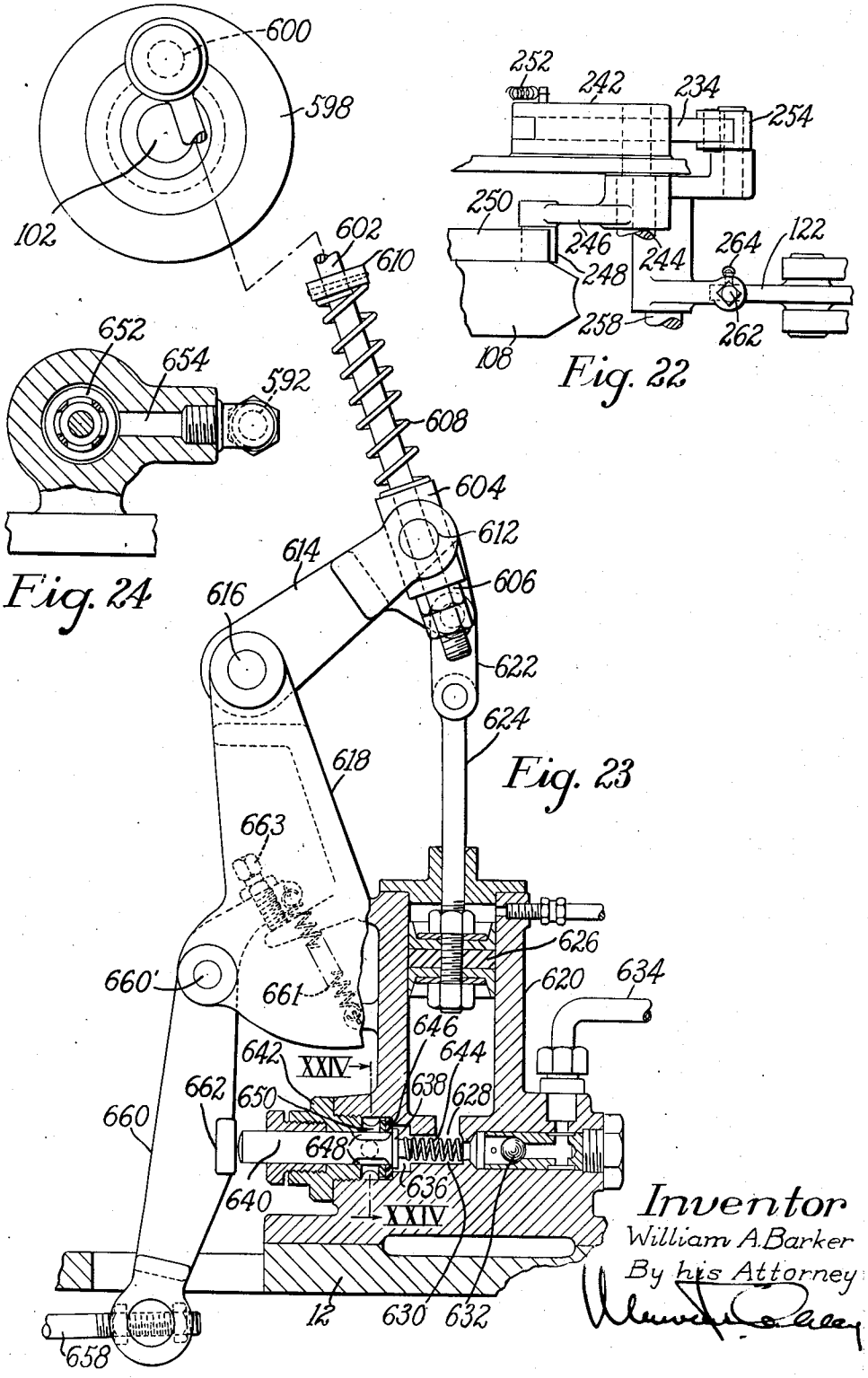

Fig. 24

Fig. 22

Fig. 23

Inventor
William A. Barker
By his Attorney

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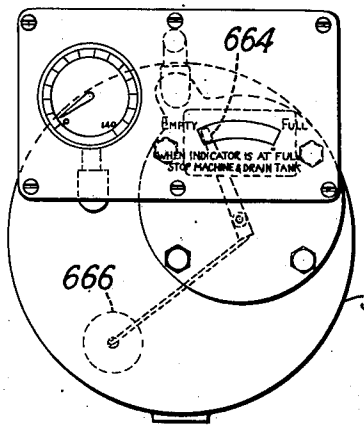
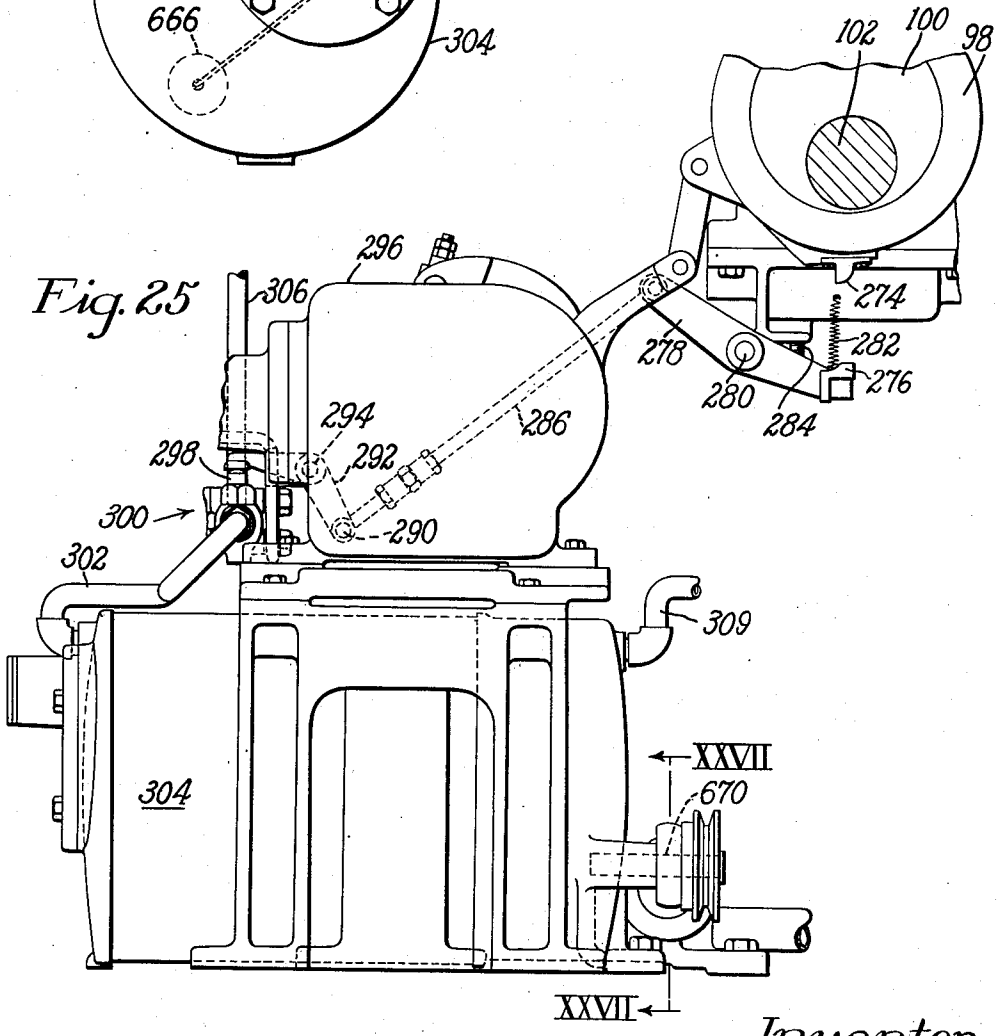


Fig. 26.

Fig. 25



Inventor
William A. Barker
By his Attorney

Feb. 9, 1954

W. A. BARKER

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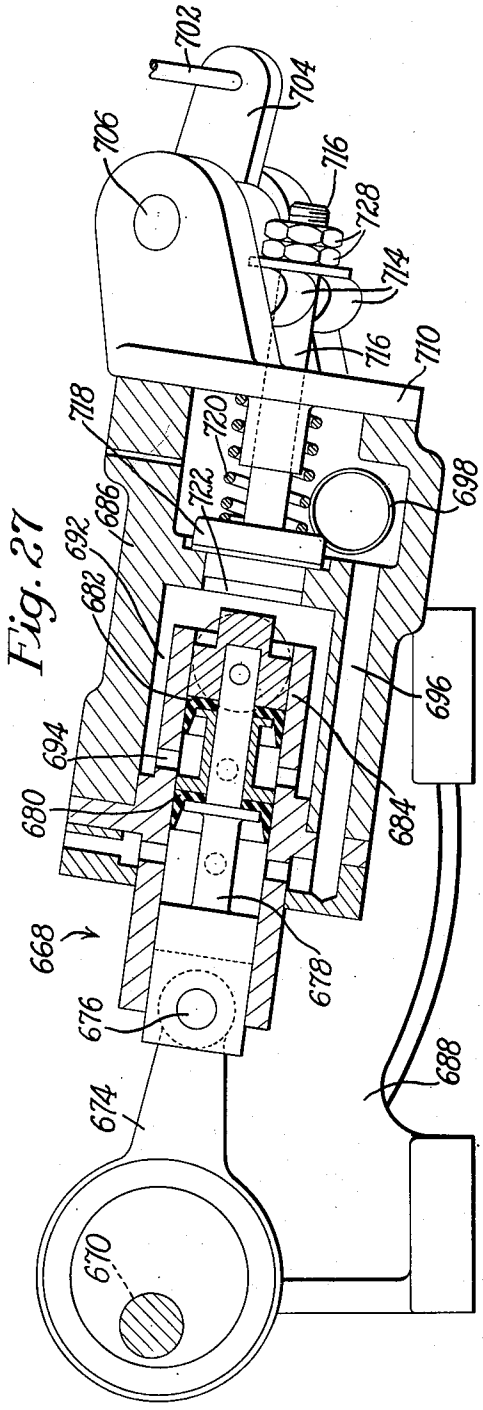
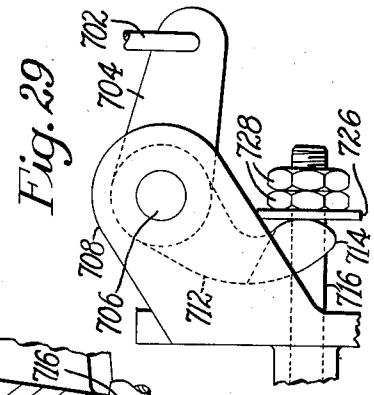
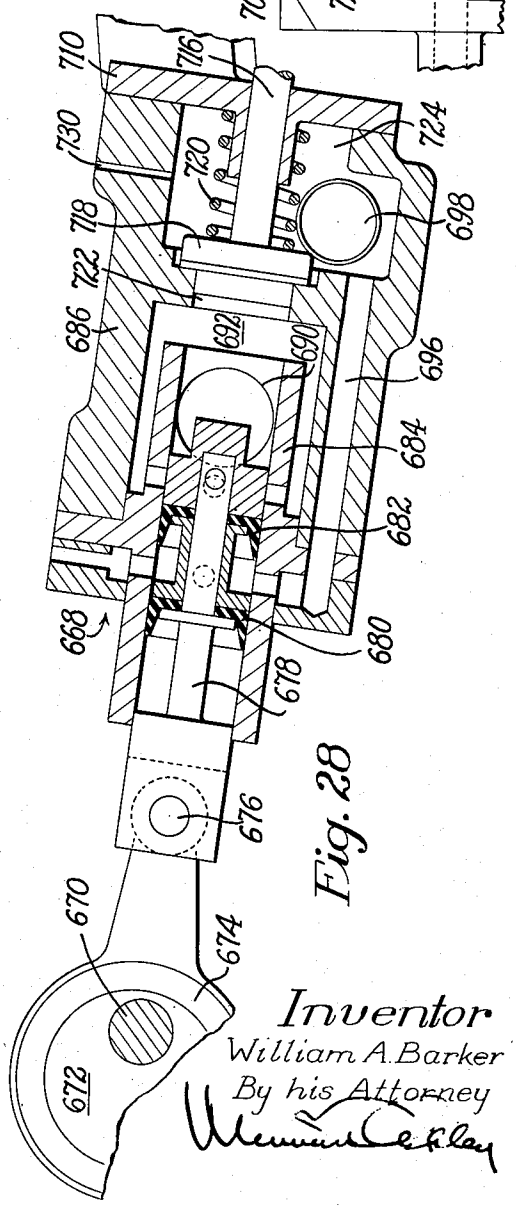
15 Sheets-Sheet 14







Inventor

William A. Barker

By his Attorney

Feb. 9, 1954 W. A. BARKER 2,668,384

APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

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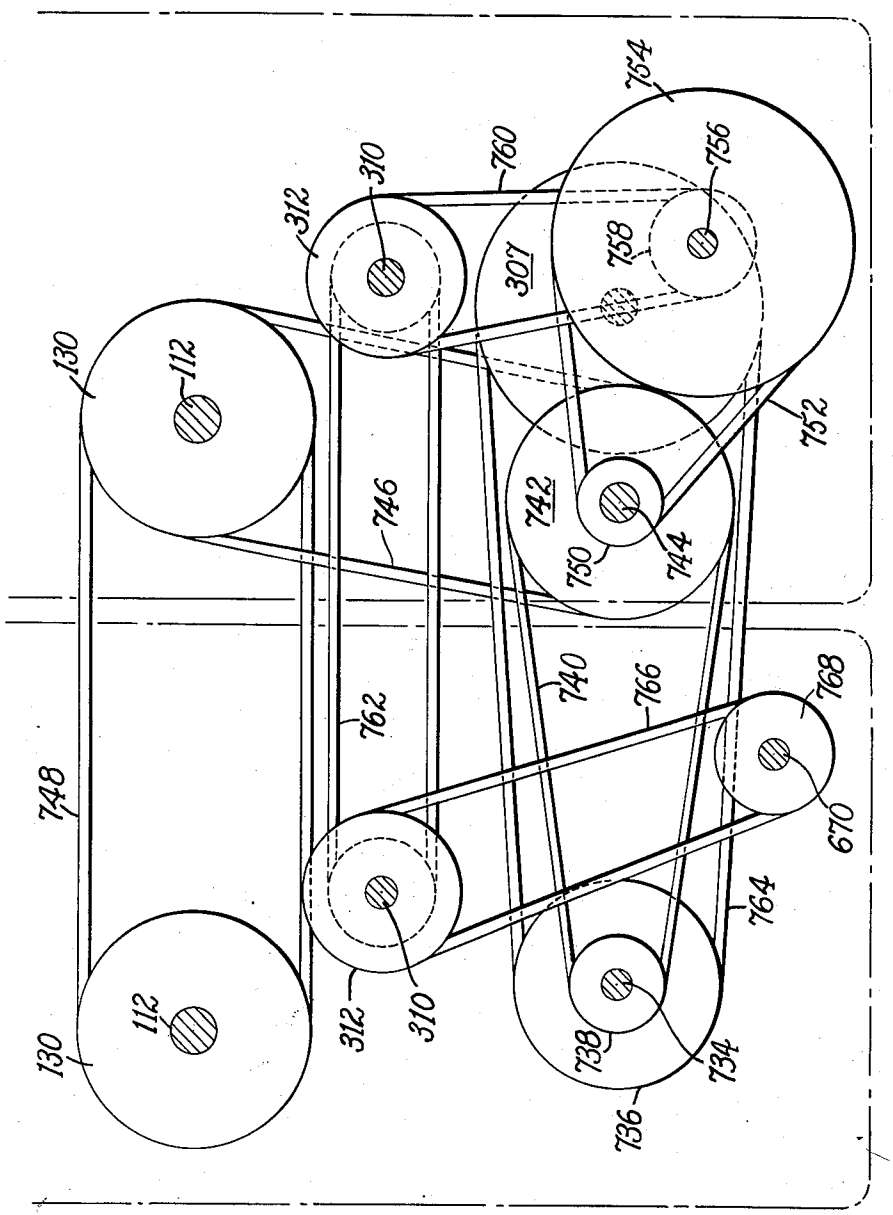

Fig. 30

Inventor
William A. Barker
By his Attorney

Patented Feb. 9, 1954

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UNITED STATES PATENT OFFICE

2,668,384

APPARATUS FOR IMPRESSING TRANSFER DESIGNS UPON POTTERY BLANKS

William Arthur Barker, Leicester, England, assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application August 5, 1950, Serial No. 177,813

Claims priority, application Great Britain September 1, 1949

10 Claims. (Cl. 41—1)

1

This invention relates to apparatus for use in ornamenting work pieces and more particularly to apparatus for impressing paint from a transfer upon a pottery blank. The invention is illustrated in a machine of the type shown in application for Letters Patent of the United States Serial No. 66,111, filed December 18, 1948, in the name of N. V. Germany. Such a machine includes a pair of flexible diaphragms which are preferably substantially impervious to air, these diaphragms being arranged to operate on opposite sides of a pottery blank to apply pressure thereto. The diaphragms are carried by supports providing pressure chambers into which pressure fluid, such as air, is admitted when the supports are in juxtaposition to each other, but previous to admitting air into the chambers the air between the diaphragms is exhausted, thus permitting intimate contact of the diaphragms with the opposite sides of the pottery blank being operated upon.

It is an object of the present invention to provide improved apparatus of the type referred to above which is so constructed as to require a minimum of skill and attention on the part of the operator.

In the illustrated embodiment of the invention, a lower work supporting diaphragm is carried by a stationary support, an upper diaphragm being carried by a support pivoted to a beam which is, in turn, pivoted about a horizontal axis on the frame of the machine so that by rocking the beam about its pivotal axis, the upper diaphragm is moved toward or away from the work carried by the lower diaphragm. In order to avoid damage to the diaphragms by admission of air pressure into the chambers and building up a pressure therein when the diaphragms are not in juxtaposition to each other, and in accordance with a feature of the invention, the chambers formed by the upper and lower diaphragms and their supports are open to the atmosphere when the upper support is in its upper position so that if at this time air be admitted by malfunctioning of the apparatus, for example, into the chambers, it will merely exhaust to the atmosphere without distending the diaphragms. The openings by which the chambers have communication with the atmosphere when the upper support is in inoperative position are so arranged as to provide communication between the lower and the upper chambers and to cut off the communication with the atmosphere when the upper support is moved downwardly into operative position with respect

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to the lower support. Consequently, air admitted into the lower support will pass through the aforementioned openings into the upper support, the openings being in direct communication, and of sufficient size that the pressure will increase in the two chambers at substantially the same rate.

In accordance with a further feature of the invention, means is provided for automatically causing the exhaust of air from the space between the diaphragms in response to the completion of the downward movement of the upper support and for admitting pressure fluid into the chambers a predetermined time thereafter to force the diaphragms against the work, the pressure being maintained for a predetermined period of time after which the pressure fluid is exhausted and the clutch re-engaged to raise the upper support to carry its diaphragm out of contact with the work, permitting removal of the work from the machine. Thus all portions of the cycle of operation are automatic after the support has moved downwardly and the length of time which elapses between the moment when the space between the diaphragms is first connected to a source of suction and the moment when pressure fluid is admitted to the chambers as well as the length of time the pressure is maintained is constant for each cycle of operation of the machine, thus insuring uniformity of work done by the machine and eliminating the necessity of the operator giving any attention to the operation of the machine at this time, thus permitting him to load the other station of the machine. In accordance with another feature of the invention, the lengths of the different portions of the cycle are readily adjusted by the operator in accordance with the requirements of the work being operated upon.

It is frequently desirable to spray water onto the lower diaphragm and onto a work piece thereon before the upper diaphragm is caused to engage the upper surface of the work. In accordance with a still further feature of the invention, operator controlled mechanism is provided for applying to the diaphragm through a spray pipe a predetermined quantity of water, this water being stored under pressure by operation of the machine during the previous cycle of operations. Thus the quantity of water that may be sprayed onto the diaphragm is constant, further insuring uniformity of quality of the work produced by the machine.

The above and other features of the invention, including novel combinations of parts and details

of construction, will now be described by reference to the drawings and pointed out in the claims.

In the drawings,

Fig. 1 is a front elevation of one form of machine in which the invention is embodied;

Fig. 2 is a right side elevation of the machine shown in Fig. 1;

Fig. 3 is a view similar to Fig. 2 of the upper portion of the machine, this view being on a somewhat larger scale than Fig. 2;

Fig. 4 is a vertical section through a valve controlling the water spray;

Fig. 5 is a vertical section through the work-engaging diaphragms and associated structure;

Fig. 6 is a vertical section of a portion of the structure shown in Fig. 5, this section being taken at right angles to that of Fig. 5;

Fig. 7 is a vertical section through the parts at the upper right hand portion of Fig. 6 and on a larger scale;

Fig. 8 is a plan view of a portion of the mechanism for locking the lower diaphragm supporting housing to the machine;

Fig. 9 is a vertical section through a portion of the drive mechanism;

Fig. 10 is a section on the line X—X of Fig. 9;

Fig. 11 is a section on the line XI—XI of Fig. 9;

Fig. 12 is a plan view of the mechanism shown at the left of Fig. 9;

Fig. 13 is a section on the line XIII—XIII of Fig. 12;

Fig. 14 is a front elevation of the mechanism shown in Fig. 12;

Fig. 15 is a section on the line XV—XV of Fig. 9;

Fig. 16 is a section along the line XVI—XVI of Fig. 9;

Fig. 17 is a side elevation of the mechanism shown at the right in Fig. 9;

Fig. 18 is a bottom plan view of a portion of the operating mechanism of the machine;

Fig. 19 is a vertical section of a portion of the mechanism shown in Fig. 18, this view being taken along the line XIX—XIX of Fig. 20;

Fig. 20 is a side elevation of the mechanism shown in Fig. 18;

Fig. 21 is a detail view of a portion of the mechanism shown in Fig. 20;

Fig. 22 is a plan view of the mechanism shown in Fig. 21;

Fig. 23 is a vertical section of a portion of the water spray control mechanism;

Fig. 24 is a section along the line XXIV—XXIV of Fig. 23;

Fig. 25 is a side elevation of a low pressure tank of the machine and the mechanism associated therewith;

Fig. 26 is a front elevation of the tank shown in Fig. 25;

Fig. 27 is a section along the line XXVII—XXVII of Fig. 25;

Fig. 28 is a view similar to Fig. 27 but showing the parts in different portions;

Fig. 29 is a detail view of a portion of the mechanism shown in Fig. 27; and

Fig. 30 is a front elevation of the belts and pulleys by which various parts of the machine are driven.

The invention is illustrated herein as embodied in a two-station machine the stations being of substantially identical constuction, like parts being indicated by like reference characters. The stations of the machine are arranged for alternate operation so that when one station is operating upon a work piece the completed work piece may be removed from the other station and a new work piece inserted therein to be operated upon during the next cycle of operations of the machine.

The machine is shown to comprise a base 10 carried by which are housings 12 providing supports 14 each of which carries a housing 16 the top of which is closed by a diaphragm 18 (Figs. 5 and 6). The diaphragm 18 is of rubber or other suitable material substantially impervious to air and is clamped against an outwardly extending flange 20 of the housing 16. For this purpose the periphery of the diaphragm 18 is clamped against the upper surface of the flange 20 by a clamping ring 22 and screws 24. An annular spacing ring 26 rests upon the outer portion of the diaphragm 18, certain of the screws 24 having enlarged portions 28 which fit in holes in the ring 26 and assist in holding the clamping ring 22 in place. These screws also have heads 30 to secure the spacing ring 26 to the upper surface of the diaphragm. As shown in Fig. 6 the spacing ring 26 is provided with a radial bore 32 passing therethrough and communicating with a pipe 34 for a purpose which will appear hereinafter.

Cooperating with the diaphragm 18 in pressing a transfer upon a work piece is an upper diaphragm 36 which is stretched across an upper support 38 by a clamping ring 40 and screws 42. A pressure chamber 44 is formed within the housing 16, the top of the chamber being closed by the lower diaphragm 18 and similarly a pressure chamber 46 is formed in the support 38 the bottom of this chamber being closed by the upper diaphragm 36. With one of the stations of the machine in inoperative condition the support 38 is elevated above the position shown in Figs. 5 and 6 so that the diaphragms 18 and 36 are spaced sufficiently to permit insertion of a work piece therebetween. The support 38 is then lowered by mechanism to be described until it is positioned adjacent to but spaced from the diaphragm 18, as shown in Figs. 5 and 6, a work piece then being confined in the space between the diaphragms. The pipe 34 is then connected to a source of suction and the air is exhausted from the space between the diaphragms whereupon they are drawn into intimate contact with the work piece following which air under pressure is admitted into the chambers 44, 46 to apply pressure through the diaphragms to the work, pressing the transfers against one or both faces of the work.

The support 38 by which the upper diaphragm 36 is carried is provided with three equally spaced upwardly extending lugs 48, 50 and 52 (Figs. 1 and 2). The lugs 48 and 52 are arranged to hook over pins 54 carried by a supporting bracket 56 having an upwardly extending lug 58 (Fig. 3) pivoted on a pin 60 carried by a forwardly and rearwardly extending beam 62. The lug 50 has a bore for the reception of a pin 64 arranged to pass through ears 66 depending from the bracket 56. The upper support 38 is thus firmly held by the supporting bracket 56 but by withdrawing the pin 64 it may be readily removed and replaced by a support having a differently shaped diaphragm. As shown in Fig. 6 the supporting bracket 56 has a surface 68 formed as part of a sphere which cooperates with a correspondingly shaped member 70 carried by a central portion of the support 38 and by means of which downward thrust of the bracket 56 is applied to the support 38.

For moving the support 38 vertically to carry its diaphragm into and out of cooperative relation with the diaphragm on the housing 16 the beam 62 is arranged for swinging movement as will now be described. As shown in Fig. 3 a pin 72 is carried in bearings in the rearward portion of the beam 62 and is provided with a central eccentric portion 74 upon which is pivoted one end of a link 76 the other end of which is pivoted on a pin 78 carried by a post 80 secured to and extending upwardly from the housing 12. The beam is U-shaped in cross section and straddles the upper end of the post 80. The pin 72 with the eccentric portion 74 provides means for adjusting the heightwise position of the rearward end of the beam 62. Carried by and secured to the pin 72 is a sector 82 having an arcuate slot 84 through which passes a locking screw 86 threaded into the beam 62 for locking the shaft in the desired position. A link 88 connected between a pin 90 carried by the beam and a pin 92 on the post 80 cooperates with the link 76 to guide the beam in its up and down movement.

For moving the beam up and down a link 94 is pivotally connected to the beam by a pin 96 the lower end of the link being formed with a strap 98 encircling an eccentric 100 keyed to a shaft 102 journaled in brackets 104, 106 (Figs. 18 and 19) depending from the upper portion of the housing 12. The shaft 102 has secured to one end thereof a worm gear 108 meshing with a worm 110 secured to a shaft 112 extending forwardly and rearwardly of the machine and rotatably mounted in bearings in the bracket 104. Also carried by the bracket 104 is a housing 114 (Fig. 20) for a clutch 116 into which the shaft 112 extends. The clutch 116 is of any suitable construction and is preferably of the type having a swash ring having a projecting dog 118, the arrangement being such that when the dog 118 is held in the position shown in Fig. 20 by a shoulder 120 on a lever 122 pivoted on a pin 124 carried by the housing 114, the clutch is disengaged and a plate 126 is held in engagement with a stationary brake surface 128, but upon release of the dog 118 by counterclockwise movement of the lever 122 in a manner to be described, the plate 126 moves to the right under the action of a spring (not shown) into engagement with a drive pulley 130 whereupon the shaft 112 is driven. The details of construction of the clutch 116 form no part of the present invention and accordingly are not disclosed herein. The pulley 130 is mounted upon the shaft 112 for free rotation relative thereto and is continuously driven by a belt as will be described.

Swinging of the lever 122 in a counterclockwise direction to cause rotation of the shaft 112 and downward movement of the beam 62 is effected by a pair of handles 132, 134 (Fig. 1) by mechanism to be described, the arrangement being such that the handles must be simultaneously operated to cause downward movement of the beam and must be held in operative position until the upper work engaging diaphragm is adjacent to the lower diaphragm thus eliminating danger of a hand of the operator being caught between the diaphragms and injured.

The handle 134 (Fig. 9) is secured to a rod 136 mounted for sliding movement in a sleeve 138 secured to and extending rearwardly from the front wall of the housing 12. The rod 136 is provided with a radially extending pin 140 received in a slot 142 in the sleeve 138 to prevent rotary movement of the rod relatively to the sleeve. A spring 144 acting between a plate 146 secured to the front wall of the housing 12 and a collar 148 fixed to the rod 136 urges the handle rearwardly. The collar 148 has a transversely extending pin 150 received by a forked portion 152 of the upper end of a lever 154, the lower end of which is pivoted upon a pin 156 (Fig. 14) carried by a lug 158 depending from a control box 160 carried by the housing 12. A collar 162 (Fig. 9) forming part of the handle 134 cooperates with the plate 146 to determine the rearward position of the handle.

Carried by the lever 154 intermediate its ends is a transversely extending pin 164 (Figs. 9 and 14) having a head 166 providing a bearing for a vertically extending pin 168 carried by the forked right end 170 of a lever 172. The other end of the lever 172 is similarly connected to the handle 132. The lever 172 is pivoted upon a vertical pin 174 fixed in a forked end portion of an arm 176 pivoted upon a vertical pin 178 secured to the control box 160. It will be understood that the lever 172 will be moved forwardly upon forward movement of the handles 132, 134 by the rocking movements imparted to the vertically extending levers 154. Because the lever 172 is carried by the pivoted arm 176 this arm will be moved in a clockwise direction as viewed in Fig. 12 in response to the movement of the lever 172 by the handles, the extent of movement of the lever 172 and of the arm 176 depending upon whether or not both handles are moved forwardly. Stop screws 180 cooperate with the lever 172 to limit the forward movement thereof. It will be understood that if only one of the handles is moved forwardly only one end of the lever 172 will move and consequently the arm 176 will not be moved as far as if both handles were moved. To cause engagement of the clutch 116 (Fig. 20) by connections to be described it is necessary that maximum movement be imparted through the handles, the lever 172 (Fig. 12) and the arm 176.

Secured to the arm 176 is a face plate 182 engageable with the outer end of a curved arm 184 secured to a vertical pivot pin 186 in a bearing 188 in the control box 160. To the lower end of the pin 186 is secured a forked arm 190 the arms 184, 190 being urged in a clockwise direction, as viewed in Fig. 12, by a tension spring 192 connected between a hook 194 in a pin 195 on an arm 196 integral with the arm 190 and a hook secured to the control box 160, the spring normally holding the arm 184 in engagement with the plate 182.

Between the bifurcations of the arm 190 is pivoted on a vertical pin 198, a pawl 200 urged clockwise about the pin by a compression spring 202 seated in a recess in a boss 204 in the arm 190 and engaging a tail 206 of the pawl. The pawl is thus normally held by the spring in a position in which a corner plate 208 formed on a slide block 210 lies within a recess in the pawl 200 as shown in Fig. 12. The slide block 210 is mounted for forward and rearward sliding movement in a guideway in the control box 160 and is urged rearwardly by a compression spring 212 (Fig. 13) lying in a bore 214 in the block 210 the forward end of the spring engaging a plunger 216 arranged for sliding movement in the bore 214 and abutting a cover plate 218 of the box 160. The slide block 210 is normally urged by the spring 212 rearwardly into a position determined by the engagement of a stop screw 220 threaded through

a lug 222 of the slide block with a lug 224 of the box 160.

The slide block 210 projects rearwardly from the control box as shown in Fig. 12 and has a slot in which is received a transverse pin 226 carried by bifurcations 228 of a rod 230, the bifurcations straddling the rearward end of the slide block 210. The pin 226 and the slot in the slide block provide a lost motion connection between the slide block 210 and the rod 230. The rod 230 extends rearwardly and is pivoted at its rearward end to an arm 232 (Fig. 20) of a lever 232, 234 pivoted on a pin 236 (Fig. 21) which is carried by spaced portions 238, 240 (Fig. 18) of a plate 242 fixed to a pin 244 mounted in bearings in the bracket 104. Also fixed to the pin 244 is an arm 246 (Fig. 21) carrying a cam roll 248 engageable with a cam 250 secured to the gear 108, the roll 248 being held in engagement with the cam by a tension spring 252 one end of which is connected to the arm 246 and the other end to the bracket 104. The upper end of the lever 232, 234 is connected by a link 254 to an arm 256 of a lever pivoted on a pin 258 fixed in the bracket 104. A second arm 260 of this lever overhangs an end of the lever 122 and carries an adjustable stop screw 262 engageable with the lever 122. A tension spring 264 urges the lever 122 in a clockwise direction as viewed in Fig. 20 into engagement with the stop screw 262.

It will be understood that when the handles 132, 134 (Fig. 1) are pulled forwardly to move the lever 172 (Fig. 12) into its forward position in engagement with the stop screws 180 the pawl 200 moves the slide block 210 forwardly against the action of spring 212, pulling the rod 230 forwardly causing clockwise movement of the lever 232, 234 (Fig. 20) which turns the lever 256, 260 in clockwise direction moving the lever 122 in a counterclockwise direction out of engagement with the dog 196 thus permitting engagement of the clutch 116. As heretofore explained, if only one of the handles 132, 134 is pulled forwardly the arm 176 is not moved into its forwardmost position and the forward movement of the rod is insufficient to move the lever 122 out of a locking engagement with the dog 118 and the clutch is not permitted to engage. Assuming that the operator moves both hands forwardly to permit engagement of the clutch and then releases his hand from one of the handles the lever 122 will move back into a position to drop behind the dog 118 and cause disengagement of the clutch after it has completed a revolution thus interrupting rotation of the worm 110 and downward movement of the beam 62, carrying the upper diaphragm. Thus if the operator releases his grip on either of the handles prior to the time that the upper diaphragm has moved downwardly into operative relation to the work, downward motion of the beam will be arrested by disengagement of the clutch at the completion of that revolution thereof during which time the operator has released his grip on either of the control handles. After a sufficient number of revolutions of the shaft 112, at which time the beam has descended sufficiently to carry the upper diaphragm into work-engaging position, the cam roll 248 enters a depression 266 in the cam 250 whereupon the arm 242 and pin 236 supporting the lever 232, 234 are swung forwardly by the spring 252 into a position such that even though the handles 132, 134 are held in their forward positions the lever 122 is permitted to swing clockwise into the position shown in Fig. 20 to cause disengagement of the clutch with the beam in its lowermost position.

For maintaining the support 38 for the upper diaphragm (Fig. 3) in horizontal position during operation of the beam 62 to lower the support 38 a link 268 is pivotally connected at one end at 270 to the link 88 and at its other end by a pin 272 to the lug 58 of the supporting bracket 56. The arrangement is such that the diaphragm carried by the support 38 is maintained in a substantially horizontal position during vertical movements of the support by operation of the beam 62. The pressure of the support 38 against the spacer ring 26 is controlled by rotation of the shaft 72 with the eccentric portion 74 by loosening the screw 86 and turning the sector 82 as heretofore described.

When the upper diaphragm support has been moved into its lowermost position air is exhaused from the space between the diaphragms by connecting the pipe 34 to a source of suction. For this purpose a dog 274 (Figs. 18, 20 and 25) carried by the eccentric strap 98 engages a cam plate 276 carried by one end of a lever 278 pivoted at 280 to a lug of the bracket 104. The lever 278 is urged by a spring 282 into the position shown in Fig. 20 in which a stop screw 284 carried therewith engages the bracket 104. As the shaft 102 comes to rest at the completion of a half revolution the dog 274 acting through the plate 276 moves the lever 278 in a clockwise direction against the action of the spring 282 thus moving a rod 286 connected at 288 to the lever 278 to the right as viewed in Fig. 25. The forward end of the rod 286 is pivoted at 290 to one end of a lever 292 pivoted at 294 upon a control box 296. The other end of the lever 292 overlies a stem 298 of a valve 300. This valve controls communication between a pipe 302 which communicates with a tank 304 and a pipe 306 which communicates with the pipe 34, the valve 298 being open and establishing communication between the tank 304 and the pipe 34 when the valve stem 298 is depressed. Sub-atmospheric pressure is maintained within the tank 304 by a pump 305 (Fig. 2) driven by a pulley 307, the low pressure side of the pump being connected to the tank by a pipe 309 (Fig. 25). It will thus be seen that upon movement of the upper diaphragm support into its operative position the valve 300 is opened and air is exhausted from the space between the diaphragms.

Following this, air under pressure is admitted into the chambers 44, 46 (Fig. 5) and the air is subsequently permitted to exhaust from the chambers and the upper diaphragm suport 38 is elevated. The several steps in the operation of the machine take place automatically at the conclusion of predetermined intervals measured from the time at which the shaft 112 comes to rest as determined by the settings of dials 306, 308 (Figs. 1 and 11), as will be hereinafter described.

Mounted for rotation in bearings in the box 296 (Figs. 9 and 15) is a forwardly and rearwardly extending shaft 310, the rearward end of which carries a pulley 312 by which it is continually connected to a source of power while the machine is in use. The shaft 310 carries an eccentric 314 (Fig. 15) surrounded by an eccentric strap 316 an extension of which is pivotally connected at 318 to a lever 320. This lever comprises spaced arms 322, 324 (Fig. 9) which are mounted for swinging movement about the same axis, the arm 322 being pivoted upon a bushing 326 carried by the box 296 and the arm 324 being pivoted upon a shaft 328 within the bushing 326 and projecting forwardly

and rearwardly thereof. Between the arms 322, 324 is a ratchet wheel 330 splined to the shaft 328 with which cooperates a driving pawl 332 pivoted upon an enlarged portion of a pin 334 (Fig. 15) which passes through the arms 322, 324 to maintain them in spaced relation, the pin being threaded to receive nuts 336.

Rotation of the ratchet wheel 330 in a clockwise direction as viewed in Fig. 15 is prevented by a pawl 338 pivoted on a stud 340 in the control box 296 and urged into engagement with the ratchet 330 by a spring 342. The pawl 332 is urged in a counterclockwise direction about the pin 336 by a tension spring 344 and if permitted to engage the teeth of the ratchet wheel 330 the wheel will be driven step by step in a counterclockwise direction upon rotation of the shaft 310 by the rocking movement imparted to the lever 320. However, when the upper diaphragm support is in an elevated position the pawl 332 is maintained out of contact with the wheel 330 by engagement of a face plate 346 with a roll 348 carried by a tail of the pawl 332 so that the pawl swings to and fro idly. The face plate 346 is fixed to one arm of a lever 350 pivoted at 352 within the box 296. The lever 350 carries a cam roll 354 (Fig. 17) maintained by a spring 356 in engagement with the periphery of a cam 358. This cam is secured to a transversely extending shaft 360 journaled in bearings in the box 296. Fixed to the shaft 360 is an arm 362 to which is pivotally connected at 364 a rod 366. Slidably mounted upon the rod is a turn block 368 pivotally mounted at 370 in a bifurcated end portion 372 of an arm 374, the block 368 being engaged at one side by a nut 376 and at the other side by a compression spring 378 surrounding the rod 368 between the block and the lower headed portion of the rod. The arm 374 is pivoted upon a stud 380 and is integral with an arm 382 (Fig. 9). The arm 382 is pivoted at 384 to one end of a link 386, the other end of which is pivoted at 388 to a lug 390 upon the eccentric strap 98 (Fig. 3).

The shaft 328 is normally locked against rotation in either direction by mechanism which will now be described. Secured to the rearward end of the shaft 328 is a bevel gear 392 (Fig. 9) which meshes with a bevel gear 394 rotatable on the shaft 360 (Fig. 16). Secured to the gear 394 is a ratchet plate 396 provided with a set of notches 398 spaced 90° apart to receive in any one of four different positions of the ratchet plate a pawl 400 normally urged by a spring 402 into locking position to prevent clockwise movement of the plate 396. The pawl 400 is pivoted on a plate 399 fast with the cam 358. A stop block 404 is received by one of a second set of recesses 406 in the plate 396 when the beam carrying the upper diaphragm is not in its lower position to prevent counterclockwise movement of the plate 396 and with it the bevel gear 394 (Fig. 9). The stop block 404 is carried at the lower end of an arm 408 (Fig. 17) pivoted at 410 to a bracket 412 integral with the control box 296. A cam roll 414 carried by the arm 408 cooperates with the cam 358, the spring 356 acting to maintain the roll 414 in engagement with the periphery of the cam. With the beam in its upper position the cam 358 is located 90° counterclockwise from the position illustrated in Fig. 17, the roll 414 being in engagement with the lower portion of the cam and the stop block 404 seated in the recess 406 thus locking the ratchet plate 396 against rotation and through the gears 394, 392 (Fig. 9) locking the shaft 328 against rotation. However, when the beam is moved downwardly the parts assume the positions shown in Fig. 17, the face plate 346 (Figs. 9 and 15) being moved downwardly to permit engagement of the pawl 332 with the ratchet 330 and the stop block 404 (Fig. 17) being withdrawn to permit counterclockwise movement of the plate 396 and turning movement of the shaft 328 in a step-by-step manner in response to movements of the pawl 332 (Fig. 15) by the constantly driven shaft 310.

The dials 306, 308 move with the shaft 328 and control, in accordance with their settings, the interval between the opening of valve 300 (Fig. 25) to exhaust the air from between the diaphragms and the time at which air under pressure is admitted into the chambers behind the diaphragms as well as the interval between the admission of air under pressure into the chambers and exhaust of the air therefrom, as will appear as the description proceeds.

The dial 308 carries a cam roll 416 (Fig. 14) which rotates with the dial and after a predetermined period in the rotation of the shaft 328 (Fig. 9) acts upon one end of an arm 418 to turn it in a clockwise direction thus causing opening of a valve 420 to admit air under pressure to the chambers behind the diaphragms. The arm 418 is fixed to a shaft 422 mounted in bearings in the control box 160 and also fixed to the shaft 422 is an arm 424 connected by a link 426 to one arm of a bell crank lever 428 pivoted at 430 on the box 160. The other arm of the bell crank lever 428 carries a roll 432 engageable with an arm 434 pivoted at 436 on the housing of valve 420. The arm 434 overlies a valve stem 438 the arrangement being such that clockwise movement of the arm 418 by the cam roll 416 causes downward movement of the valve stem 438 and admission of air under pressure into the spaces behind the diaphragms. The bell crank lever 428 is moved in a counterclockwise direction in opening the valve 420 and the roll 432 enters a depression 440 in the arm 434 thus locking the valve stem 438 in its down position against the action of a spring causing the valve to remain open after the cam roll 416 passes the end of arm 418.

For returning the bell crank 428 to the position shown in Fig. 14 after a predetermined time to permit closure of valve 420 the dial 306 carries a cam roll 442 which moves into engagement with an arm 444 fixed to the shaft 422 to turn the shaft in a counterclockwise direction and return the parts to the position illustrated. A second cam roll 446 is carried by the dial 306 causing tripping of the clutch 116 a second time to cause lifting of the beam 62 as will be hereinafter explained.

The setting of the dial 308 with respect to the shaft 328 determines the extent of rotation required of the shaft 328 before the valve 420 is opened and hence determines the length of time which elapses from the connection of the space between the diaphragms to the suction tank and the time that pressure is admitted behind the diaphragms. A sleeve 448 (Fig. 9) is mounted for rotation in a bearing 450, the sleeve 448 providing a bearing for a sleeve portion 452 of the dial 308. The forward portion of the dial 308 is in the form of a cylinder 454 and has attached to it a plate 456 carrying the cam roll 416. The sleeve portion 452 of the dial 306 is urged forwardly by a compression spring 458 surrounding the forward end of the shaft 328 and engag-

ing at one end an internal shoulder formed on the sleeve 452. The other end of the spring engages a plate 460 carried by the shaft 328. The dial 308 normally occupies, under the action of the spring 458, a forward position determined by engagement of the internal shoulder on the sleeve 452 with a washer 462 secured to the forward end of the shaft 328. The rearward end of the sleeve 452 is formed with external teeth 464 (Fig. 11) which are engageable with internal teeth formed in a sleeve 466 secured to the plate 460, with the dial 308 in its forward position. Accordingly with the dial in this position it is connected to the shaft 328 for rotation therewith. However, if the dial 308 is pushed rearwardly against the action of the spring 458 the cooperating teeth on the sleeve 452 and the sleeve 466 are disengaged and the dial 308 may then be turned with respect to the shaft to vary the position of the cam roll 416 relatively to the shaft. After the roll has been properly set the dial 308 is permitted to return to its forward position in which it is again connected as heretofore described to the shaft 328 for rotation therewith. A scale 468 carried by the dial 308 cooperates with an index mark 470 (Fig. 1) on a cover plate 472 on the housing 12 to assist the operator in making the proper setting of the dial 308. A pin 474 (Fig. 11) carried by the plate 460 is received in a recess in the sleeve 452 to limit the adjustment of the dial 308 with respect to the shaft 328.

The interval between the opening of valve 420 (Fig. 14) and subsequent closure thereof depends upon the angular relation between the cam rolls 416 and 442 and is varied by adjustment of the dial 306 carrying the cam roll 442. The dial 306 rotates within the forward portion of the dial 308 (Fig. 9) and has secured to it a rearwardly extending shaft 476, the rearward portion of which is enlarged and is supported by the sleeve 452 of the dial 308. A pin 478 is carried by the rearward end of the shaft 476 and extends laterally thereof through a slot 480 (Fig. 10) in the sleeve 452 into a hole in the sleeve 448. The slot 480 in the sleeve 452 permits relative forward and rearward sliding movement and limited rotary movement between the sleeve 452 and the shaft 476 or in other words between the dials 308 and 306.

A spring 482 acting between the washer 462 on the shaft 328 and the rearward end of the shaft 476 urges the dial 306 forwardly into a position determined by the engagement of the forward end of the sleeve 448 with a shoulder formed on the forward end of the sleeve 452. The rearward end of the sleeve 448 has internal teeth 484 engageable with external teeth formed on the sleeve 452 so that with the dial 306 in its forward position it moves as a unit with the dial 308 and the shaft 328. Upon moving the dial 306 rearwardly against the action of the spring 482 the aforementioned teeth are disengaged permitting turning of the dial 306 relatively to the dial 308 to move the cam roll 442 into the desired position. A scale 486 cooperates with an index mark 488 on the dial 308 to assist the operator in making the proper adjustment of the dial 306 with respect to the dial 308.

The valve 420 (Fig. 14) is connected by a pipe 490 to the chambers 44, 46 (Figs. 5 and 6) as will be explained. The inlet of the valve 420 is connected by a pipe 492 to a source of air under pressure the arrangement being such that upon depression of the plunger 438 pipes 490, 492 are placed in communication and when the plunger 438 is allowed to return to the position illustrated in Fig. 14 communication between the pipes is cut off and the pipe 490 is opened to the atmosphere through a small port (not shown) in the housing of valve 420.

The housing 16 on which the lower diaphragm is supported (Figs. 5 and 6) is removably carried by the support 14 so that it may be readily replaced by a housing having a differently shaped diaphragm if desired, for operating upon work pieces of different shapes. An annular depending flange 494 is received by a centrally disposed recess 496 in the support 14 and is removably held in place by a plunger 498 slidable in a hole in the support 14 and normally held in the position shown in Fig. 6 in engagement with a groove 500 in the periphery of the cylindrical portion 494. A spring 502 acts between the plunger 498 and a cap 504 threaded into the outer portion of the hole in which the plunger slides. A rod 506 connected to the plunger 498 extends outwardly through the cap 504 and has pivoted to it a handle 508 having a cam portion 510 so arranged that when the handle is pivoted in a counterclockwise direction as viewed in Fig. 8 the plunger is moved outwardly against the action of the spring 502 permitting removal of the housing 16. A dowel pin 512 carried by the support 14 fits into a recess in the bottom wall of the housing 16 to locate the housing properly with respect to the support.

A nozzle 514 is threaded into the bottom wall of the housing 16 and extends downwardly therefrom. Secured centrally within the recess in the support 14 is an annular washer 516 to the upper surface of which is secured a collar 518. This collar is recessed and cooperates with the washer 516 to accommodate a packing ring 520 in which the lower portion of the nozzle 514 seats when the housing 16 is located on the support 14 to provide an air tight connection between the chamber 44 and a passageway 522 in the support 14. Secured to the underside of the support 14 is a housing 524 for a valve assembly which includes a check valve 526 normally held by a spring 528 in position to interrupt the flow of air from the pipe 490 through a vertically extending passage 530 into the passage 522 in the support 14. The passage 522 normally communicates with the atmosphere through a chamber 532 in the upper portion of the housing and a port 534 in the wall of the housing. A cylinder 536 is formed in the lower portion of the housing 524 and slidable therein is a piston 538 to which is secured an upwardly extending rod 540 carrying at its upper end a valve member 542. This valve member carries an annular sealing ring 544 which with the valve member in its uppermost position closes the passageway 522 to the chamber 532.

If there is no pressure in the pipe 490 the check valve 526 is closed, the piston 536 and valve member 542 are in their lower positions and the chamber 44 communicates through the port 534 with the atmosphere. If now the valve 420 (Fig. 14) is opened the air pressure acts on the piston 538 to move it upwardly into the position shown in Fig. 5. As the pressure builds up the check valve 526 is opened permitting flow of air directly into the chamber 44. The area of the valve 542 which is exposed to the air pressure is less than that of the piston 538 so that the piston and the valve member remain in the positions shown in Fig. 5 until the valve

420 is closed, whereupon the pressure in the pipe 490 drops as heretofore explained. The pressure on the top of the valve member 542 is now sufficient to force the valve and piston 538 downwardly whereupon the air in the chamber 44 exhausts through the port 534 to the atmosphere.

With the upper support 38 in its operative position with respect to the housing 16, as shown in Figs. 5, 6 and 7, the chambers 44, 46 are in direct communication so that the pressure in the chamber 46 builds up substantially as fast as the pressure in the chamber 44. For this purpose the wall of the housing 16 has a laterally extending boss 546 having a passage 548 therein opening into the chamber 44. Threaded into the top wall of the boss 546 is a nozzle 550 having a passageway therethrough of large cross section. The support 38 is provided with a laterally extending boss 552 having a passage 554 therein in direct communication with the chamber 46 and having an opening 556 in its lower wall. An annular collar 558 is secured to to the underside of the boss 552 and accommodates a packing gland 560 which cooperates with the nozzle 550 when the support 38 is in its down position to provide an air tight passageway between the upper and lower chambers. Should compressed air be admitted into the chamber 44 without the support 38 being firmly seated upon the ring 26, due for example to malfunctioning of the machine or due to the operator inadvertently tripping the clutch without there being a support 38 present in the machine, the compressed air will blow out into the atmosphere through the nozzle 550 and no harm will result for example by distending and bursting of the diaphragm 18.

The last portion of the cycle of operation is initiated by the roll 446 (Fig. 14) tripping the clutch to cause return movement of the beam into its upper position. After the dial 306 has turned a predetermined amount the roll 446 engages the lower end of a lever 562 pivoted at 564 on the box 160. The upper end of the lever 562 is connected by a link 566 to the arm 196 (Fig. 12). The roll 446 thus swings the lever 562 in a clockwise direction against the action of the spring 192 causing the pawl 200 to move the slide block 210 forwardly to a position somewhat forward of that into which it is moved by the handles 132, 134, the extent of movement of the slide block 210 being sufficient to rock the lever 122 (Fig. 20) counterclockwise enough to trip the clutch 116 a second time, initiating rotation of the shafts 112, 102. A final part of the clockwise movement of the lever 562 (Fig. 14) causes movement of the tail 206 of the pawl 200 into engagement with a stop screw 568 so that the pawl rocks counterclockwise about the pin 198 freeing the block 210 for rearward movement under the action of the spring 212.

At the beginning of the rotation of the shaft 102 the cam 250 engages the roll 248 (Fig. 21) holding the arm 122 from causing disengagement of the clutch 116. The shaft 102 thus continues to rotate until the beam reaches its upper position at which time the roll 248 enters the depression 266 in the cam 250 permitting clockwise movement of the lever 122 to cause disengagement of the clutch 116 whereupon the shaft 102 is brought to rest.

During the second half revolution of the shaft 102 the lug 390 (Fig. 9) on the eccentric strap 98 is raised and through connections 386, 382, 374, 368 (Fig. 17), 362 the cam 358 is turned counterclockwise as viewed in Fig. 17 approximately 90°. During this turning of the cam 358 the roll 354 is engaged by the high portion of the cam and moved downwardly bringing the plate 346 (Fig. 15) up against the roll 348 to disengage the pawl 332 from the ratchet wheel 330. During this time the roll 414 (Fig. 17) rides off the high portion of the cam 358 permitting the block 404 to swing into engagement with the plate 396. At this time, however, the plate will be displaced from the position shown in Fig. 17 so that the block does not move into one of the recesses 406. During this counterclockwise movement of the cam 358 the pawl carrying plate 399 moves with it carrying the pawl 400. At the beginning of this movement of the pawl it rides over one of the arcuate faces 570 of the plate 396 until it moves into one of the notches 398 causing the plate 396 to turn with the cam, the total amount of movement of the plate during a cycle of operation of the machine being 90° or the total of the motion through the step-by-step rotation of the shaft 328 and the movement given to it by the pawl 400. The plate 396 is thus set in a position in which one of the notches 398 is at the top as shown in Fig. 17, and since there are four equally spaced notches the plate has four different positions spaced 90° apart in which it comes to rest. The ratio between the gears 394, 392 is 4:1 so that whenever the plate 296 is in any one of the four positions the bevel gear 392 and the shaft 328 occupy the same position. The shaft 328 and the dials 306, 308 are thus given a partial rotation by the pawl 332 when the shaft 102 is stationary after completing its first half revolution and during the second half revolution of the shaft 102 when the beam is returned to its upper position the shaft 328 moves through the remainder of a full revolution and is returned to its initial position as shown in Fig. 9. During the first part of the second half revolution of the shaft 102 the dog 274 carried by the eccentric strap 98 permits clockwise movement of the lever 278 (Fig. 25) and closure of the valve 300.

Provision is made for applying a water spray to the lower work supporting diaphragm or to the work supported thereon or both if desired, the spray being actuated by depression of a treadle 570 (Figs. 1 and 2), prior to operation of the handles 132, 134 to initiate operation of the machine. Carried by the frame 12 are brackets 572, 574 each of which has at its upper end a bearing boss 576 (Fig. 4) having a horizontal transversely extending bore 578. Rotatably mounted within the bore 578 is a hollow stud 580 to which is fixed an upstanding arm 582, the arm being thus pivoted upon the bracket 576. The arms 582 carried by the brackets 572, 574 support a U-shaped frame 584 which in turn supports a U-shaped spray pipe 586 having ports (not shown) by which water is directed downwardly onto the work-supporting diaphragm. The spray pipe 586 is connected by way of a port 588 to the interior of the rotatably mounted stud 580 which also has a port 590 which, when the frame 584 with the spray pipe 586 is in the position shown in Fig. 2, connects with a water supply pipe 592. The frame 584 normally occupies a horizontal position determined by the engagement of a stop screw 594 (Fig. 3) carried by an extension of the arm 582 with a lug 596 on the bracket 572. To insure against unintentional discharge of water from the spray pipe 586 even though the operator inadvertently steps on the

treadle 570 the support 584 with the spray pipe 586 may be swung upwardly into an inoperative position cutting off communication between the supply pipe 592 and the interior of the hollow stud 580, the port 590 moving downwardly out of register with the pipe 592.

The valve mechanism controlled by the treadle 570 for supplying water to the spray pipe is illustrated in Figs. 23 and 24. Fixed to the shaft 102 is a crank disk 598 carrying a crank pin 600. The upper end of a rod 602 is pivoted to the crank pin 600, the lower end of the rod having slidably mounted thereon a trunnion block 604 urged downwardly into a position determined by nut 606 by a compression spring 608 acting between the block 604 and a collar 610 secured to the rod 602. The block 604 is pivoted at 612 between bifurcations of an arm 614 pivoted at 616 on a bracket 618 extending upwardly from a cylinder 620 carried by the frame 12. The arm 614 is connected by a link 622 to the upper end of a piston rod 624 the lower end of which carries a piston 626 in the cylinder 620. The interior of the cylinder communicates by way of a port 628 with a horizontal passage 630 extending forwardly and rearwardly of the machine and communicating at its rearward end by way of a check valve 632 with a pipe 634 connected to a water tank (not shown). The forward end of the passage 630 opens into a recess 636 in which is received the rearward flanged portion 638 of a valve 640 slidable in a cap 642 threaded into the forward wall of the cylinder 620. A compression spring 644 urges the valve forwardly with the flanged portion 638 held against a sealing ring 646 clamped between the adjacent portions of the cap 642 and the cylinder 620. With the slide valve member 640 in the position shown in Fig. 23 passage of water forwardly from the passageway 630 is prevented but if the valve member is moved inwardly against the action of the spring 644 the water passes through an annular channel 648 formed in the valve member through ports 650 in the cap 642 and into an annular groove 652 (Fig. 24) in the cap through a passage 654, and into the pipe 592, the amount of water sprayed during each cycle of operation being constant and determined by the bore of the cylinder 620 and the stroke of the piston 626.

The treadle 570 (Figs. 1 and 2) is pivoted at 656 to a bracket extending forwardly from the frame of the machine and is connected by a rod 658 with a lever 660 (Fig. 23) pivoted at 660' on the bracket 618. The lever is normally held in the position shown in Fig. 23 by a spring 661, the upper end of the lever carrying a stop screw 663 which engages a lug on the cylinder 620 to limit the movement of the lever 660 by the spring 661. A lug 662 carried by the lever 660 engages the forward portion of the slide valve member 640 so that upon depression of the treadle and rearward movement of the rod 658 the slide valve member 640 is moved rearwardly to open communication between the interior of the cylinder 620 and the pipe 592.

During the first half revolution of the shaft 102 during which the beam 62 (Figs. 2 and 3) is moving downwardly the pin 600 moves upwardly into the position shown in Fig. 23 moving the piston 626 upwardly within the cylinder 620 and sucking water into the cylinder from the pipe 634 and past the valve 632. During the second half revolution of the shaft 102 during which the beam 62 is returned to its uppermost position the crank pin 600 returns to its lowermost position moving the rod 602 downwardly. At this time water is trapped within the cylinder below the piston 626 so that the piston cannot descend and consequently the spring 608 is compressed and remains so until the valve member 640 is moved rearwardly, the piston 626 then being forced downwardly by the spring 608 driving water through the pipe 592 to the spray pipe 586 assuming the latter pipe is in its horizontal position, as shown in Figs. 2 and 3, whence the water is sprayed onto the work-supporting diaphragm and onto a work piece, if any, supported thereon. If the operator failed to treadle the machine but pulls the handles 132, 134 (Fig. 1) forwardly to cause engagement of the clutch on the shaft 112 the parts will merely return to the position shown in Fig. 23 during the next 180° of rotation of the shaft 102 no water being sprayed onto the lower work supporting diaphragm. Thus it will be seen that in order to operate the spray the treadle 570 must be depressed while the beam is in its upper position the spray pipe being maintained in its horizontal position.

If water is delivered by the spray pipe 586 to the lower work supporting diaphragm this water is drawn into the tank 304 (Fig. 25) upon opening the valve 300 to exhaust the air from the space between the diaphragms as heretofore explained. The quantity of water within the tank 304 is indicated by a pointer 664 (Fig. 26) mounted at the front of the tank 304, the pointer 664 being operated by a float 666 within the tank. Pumping mechanism 668 illustrated in Figs. 27 and 28 is provided to draw the water from the tank 304, the pumping mechanism being constantly in operation during operation of the machine.

The pumping mechanism 668 is driven by a shaft 670 carrying an eccentric 672 surrounded by a strap 674 pivoted at 676 to a rod 678 carrying spaced pistons 680, 682. These pistons are reciprocated in a cylinder 684 mounted within a casing 686 carried by a bracket 688 of the machine frame. A port 690 provides connection between the bottom of the tank 304 and a chamber 692 in the housing 686 so that whenever there is a quantity of water in the tank 304 the chamber 692 is full of water which passes thereinto by gravity. Ports 694 provide communication between the chamber 692 and the space between the pistons 680, 682 when they are in the right hand position, shown in Fig. 27. This space thus fills with water and when the pistons are moved to the left as shown in Fig. 28 the water then passes into a passageway 696 to a waste pipe 698. It will thus be seen that as the pump is operated the water from the tank 304 is withdrawn therefrom and is discharged through the pipe 698.

It may be desirable to drain the tank 304 completely during a time that the machine is not in operation and the pump 668 therefore not operating. For this purpose there is mounted on the left hand side of the machine near the front thereof, as shown in Fig. 1, a hand lever 700 connected by a rod 702 (Figs. 27 and 29) to a bell crank lever 704 pivoted at 706 between spaced ears 708 on a plate 710 secured to an end of the housing 686. The bell crank lever 704 includes a depending arm 712 having a bifurcated end 714 straddling a stem 716 of a valve 718 urged by a spring 720 toward the left to close a port 722 between the chamber 692 and a chamber 724 into which the drain pipe 698 opens. The bifurcations 714 of the bell crank lever 704 engage a washer 726 adjustably secured to the outer end of the valve stem 716 by nuts 728. It will

be understood that upon counterclockwise movement of the bell crank lever 704 the valve 718 is moved to the right against the action of the spring 720 to provide direct communication between the chamber 692 conected to the tank and the drain pipe 698, whereupon the tank may be drained by gravity. A vent 730 provides communication between the chamber 724 and the atmosphere.

In the interest of clarity the driving belts by which power is transmitted to various parts of the machine have been shown only in Fig. 30. The machine is operated by an electric motor 732 (Fig. 2) having a drive shaft 734 carrying pulleys 736, 738 (Fig. 30). The pulley 738 is connected by a belt 740 to a pulley 742 secured to a countershaft 744. A belt 746 transmits power from the shaft 744 to one of the pulleys 130 (Fig. 20). The pulleys 130 at opposite sides of the machine are connected by a belt 748, thus these pulleys are constantly operating so that by engagement of the associated clutch 114 the shafts 112 are driven.

The shaft 744 also carries a small pulley 750 connected by a belt 752 to a pulley 754 secured to a countershaft 756. Fixed on the shaft 756 is a pulley 758 connected by a belt 760 to the pulley 312 of the station at the right of the machine, the pulley 312 being carried by the shaft 310 (Fig. 9). The pulley 312 in the right side of the machine is connected by a belt 762 to the pulley 312 in the left side of the machine whereupon the shafts 310 are continually rotated during the operation of the machine as heretofore explained. The pulley 736 on the shaft 734 is connected by a belt 764 to the pulley 307 (Fig. 2) of the suction pump 305 so that this pump is continually operated. The speed of rotation of the drive motor 732 and the ratio of the pulleys is such that the pulleys 130 rotate preferably at 600 R. P. M. whereas the pulleys 312 rotate at 120 R. P. M. and the index marks 468, 486 (Fig. 14) which are angularly spaced apart a distance corresponding to two of the teeth of the ratchet wheel 330 (Fig. 15) may be read as representing seconds of time thus facilitating proper setting of the dials 306, 308 (Figs. 12 and 14) to adjust the machine for the desired cycle of operation. The pump 668 (Figs. 27 and 28) by which water is withdrawn from the low pressure tank is driven by a belt 766 (Fig. 30) connecting the pulley 312 in the left station of the machine with a pulley 768 on the shaft 670 to which the pump is connected.

In the operation of the machine the motor 732 is started causing rotation of the pulleys 312 at opposite sides of the machine, the pulleys 130 and the pulleys 307 and 768. Rotation of the pulleys 312 causes the pawl 332 (Fig. 15) to swing to and fro but out of contact with the ratchet wheel 330 as heretofore explained. The pulleys 130 rotate idly upon the shafts 112. Rotation of the pulley 307 causes the pump 305 (Fig. 2) to reduce the pressure in the tank 304 (Fig. 25) and the pump mechanism 668 is also operated from the shaft 670.

The dials 306, 308 (Figs. 12 and 14) at each side of the machine are set in accordance with the requirements of the run of work to be operated upon. In this manner the length of the period in the operation of the machine between the time that the space between the upper and lower diaphragms is connected to the low pressure tank 304 and the time at which air under pressure is admitted by opening the valve 420 to the chambers behind the upper and lower diaphragms may be read in seconds on the scale 468 of the dial 308, against the mark 470 (Fig. 1). To adjust the length of this period the dial 308 is pushed in and turned to the desired location and then released whereupon it moves forward again. During this time the dial 306 is moved with the dial 308 but this turning of the dial 306 has no effect upon the period controlled by the dial 308.

The length of the period during which the valve 420 remains open is indicated in seconds by the scale 486 of the dial 306 against the mark 488. To adjust the length of this period the dial 306 is pushed in and turned to the proper setting and then released. The beam 62 carrying the support 38 for the upper diaphragm is at this time in its upper position, this being true of the beams and supports at each station of the machine. A work piece to which a transfer has been applied by hand is now placed on the lower diaphragm 18 and may be sprayed with water if desired by depressing the treadle 570 at the appropriate side of the machine. The handles 132, 134 are then pulled out to trip the clutch 116 (Fig. 20) whereupon the shaft 102 is turned through 180° the support 38 (Fig. 2) being lowered until the support seats firmly against the ring 26 carried by the housing 16, as shown in Figs. 5 and 6. As the shaft 102 completes its half revolution the dog 274 engages the cam plate 276 opening the valve 300 (Fig. 25) to connect the space between the diaphragms with the tank 304. The pawl 332 now engages the ratchet wheel 330 (Fig. 15) as heretofore described and causes step-by-step rotation of the ratchet wheel and the shaft 328. The dials 306, 308 move with the shaft 328 (Fig. 9) and after a predetermined time depending upon the setting of the dial 308, the roll 416 (Fig. 14) engages the right end of the lever 418 rocking it in a clockwise direction and opening the valve 420 to admit air under pressure into the chambers 44, 46 (Fig. 5) forcing the diaphragms 18, 36 firmly into contact with opposite sides of the work piece and the transfer or transfers thereon. After a further predetermined time the roll 442 carried by the dial 306 engages the arm 444 fixed to the shaft 422 rocking it in a counterclockwise direction and closing the valve 420, permitting exhaust of the air from the chambers 44, 46 (Fig. 5) as heretofore explained. Shortly thereafter the cam roll 446 operates the lever 562 to cause engagement of the clutch 116 (Fig. 20) a second time thus returning the parts to their original positions.

Immediately after operating the handles 132, 134 at one station of the machine to initiate operation thereof the operator may place a work piece on the diaphragm at the other station of the machine since no further attention is required by the operator at the first station, the cycle of operations continuing automatically until the operation is complete and the beam 62 returns to its upper position whereupon the work piece which has been operated upon may be removed and another one substituted therefor.

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed

chambers into which pressure fluid may be admitted to force said diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means mounting one of said supports for movement into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, means for admitting pressure fluid into one of said chambers, and means providing direct communication between the upper and lower chambers when the diaphragms are in proximity to each other and providing communication between said one of said chambers and the atmosphere when the diaphragm supports are separated from each other.

2. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force said diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means mounting one of said supports for movement into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, means for admitting pressure fluid into one of said chambers, a nozzle communicating with one of said chambers and extending beyond the associated diaphragm, an adjacent wall of the other chamber having an opening therein, and means providing an air-tight connection between said opening and said nozzle when the supports are in juxtaposition.

3. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means for moving one of said supports into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, a spray pipe arranged to direct water onto the lower diaphragm or onto a work piece supported thereby, means operative in response to the operation of the machine for storing a predetermined quantity of water under pressure for subsequent delivery to said spray pipe, and means for admitting said predetermined quantity of water to said spray pipe.

4. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means for moving one of said supports into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, means operable automatically at the conclusion of the movement of the movable support toward the other support for exhausting the air from the space between said diaphragms, and means operable automatically at a predetermined time thereafter for admitting pressure fluid into said chambers to force the diaphragms into engagement with opposite sides of the work.

5. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means for moving one of said supports into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, means operable automatically at the conclusion of the movement of the movable support toward the other support for exhausting the air from the space between said diaphragms, means operable automatically at a predetermined time thereafter for admitting pressure fluid into said chambers to force the diaphragms into engagement with opposite sides of the work, and means operable automatically at a predetermined time thereafter for exhausting the fluid from said chambers.

6. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms towards each other to apply pressure to the opposite sides of the work piece placed therebetween, means for moving one of said supports into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, means operable automatically at the conclusion of the movement of the movable support toward the other support for exhausting the air from the space between said diaphragms, means operable automatically at a predetermined time thereafter for admitting fluid into said chambers to force the diaphragms into engagement with opposite sides of the work, means operable automatically at a predetermined time thereafter for exhausting the fluid from said chambers, and means for controlling the length of time that the pressure fluid remains in said chambers.

7. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means mounting one of said supports for movements into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, a valve for connecting the space between the diaphragms to a source of suction, a valve for admitting pressure fluid to said chambers, means

operable automatically in response to movement of the movable support into proximity to the other support for opening the first-named valve, and means operable automatically after a predetermined time following the opening of the first-named valve for opening the second-named valve.

8. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means mounting one of said supports for movement into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, a valve for connecting the space between the diaphragms to a source of suction, a valve for admitting pressure fluid to said chambers, means operable automatically in response to movement of the movable support into proximity to the other support for opening the first-named valve, means operable automatically after a predetermined time following the opening of the first-named valve for opening the second-named valve, and means for automatically closing the second-named valve and moving the movable support away from the other support after a further predetermined time.

9. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means mounting one of said supports for movements into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other supports, a valve for connecting the space between the diaphragms to

a source of suction, a valve for admitting pressure fluid to said chambers, means for operating said valves in timed relation, and means operable automatically after a predetermined time following admission of pressure fluid to said chambers for moving the movable support away from the other support.

10. Apparatus for impressing paint from a transfer upon a pottery blank comprising a pair of flexible diaphragms arranged for engagement with opposite sides of a work piece placed therebetween, supports for said diaphragms, said supports providing with said diaphragms closed chambers into which pressure fluid may be admitted to force the diaphragms toward each other to apply pressure to the opposite sides of the work piece placed therebetween, means for moving one of said supports into and out of proximity to the other support to carry its diaphragm into and out of cooperative relation to the diaphragm on the other support, a valve for connecting the space between the diaphragms to a source of suction, a valve for admitting air under pressure to said chambers, means for operating said valves in timed relation after the movable support has been moved into proximity to the other support, and means operable automatically a predetermined time after air under pressure has been admitted to said chambers for moving the movable support away from the other support, said supports including openings which provide communication between the chambers when the supports are in proximity to each other and provide communication between the chambers and the atmosphere when the supports are separated.

WILLIAM ARTHUR BARKER.

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