May 18, 1943 J. Q. HOLMES ET AL 2,319,232

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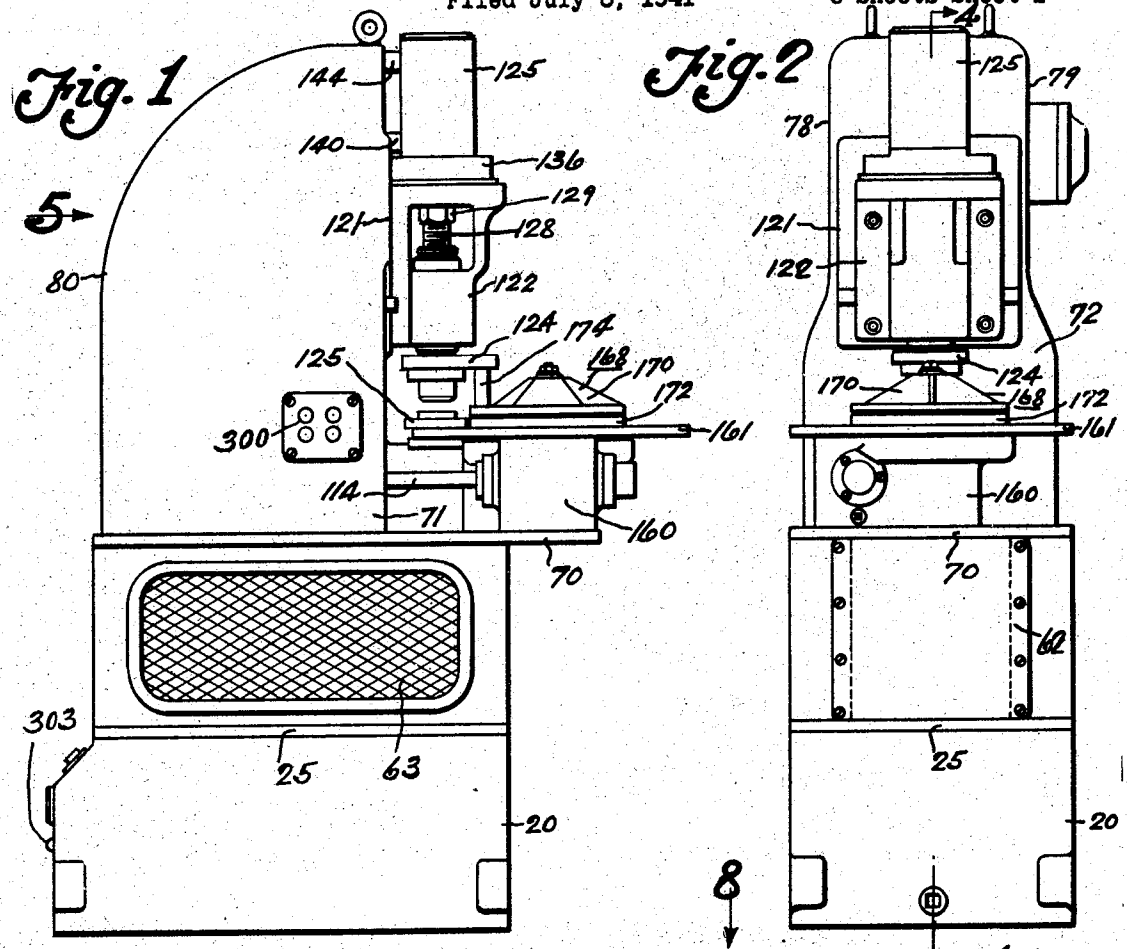

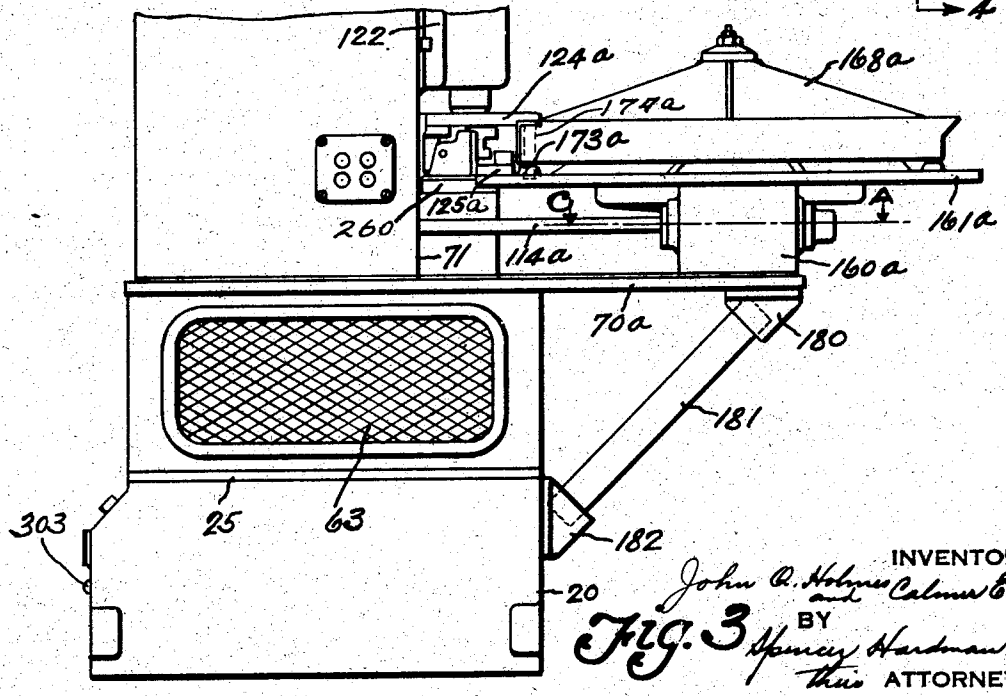

Fig. 3

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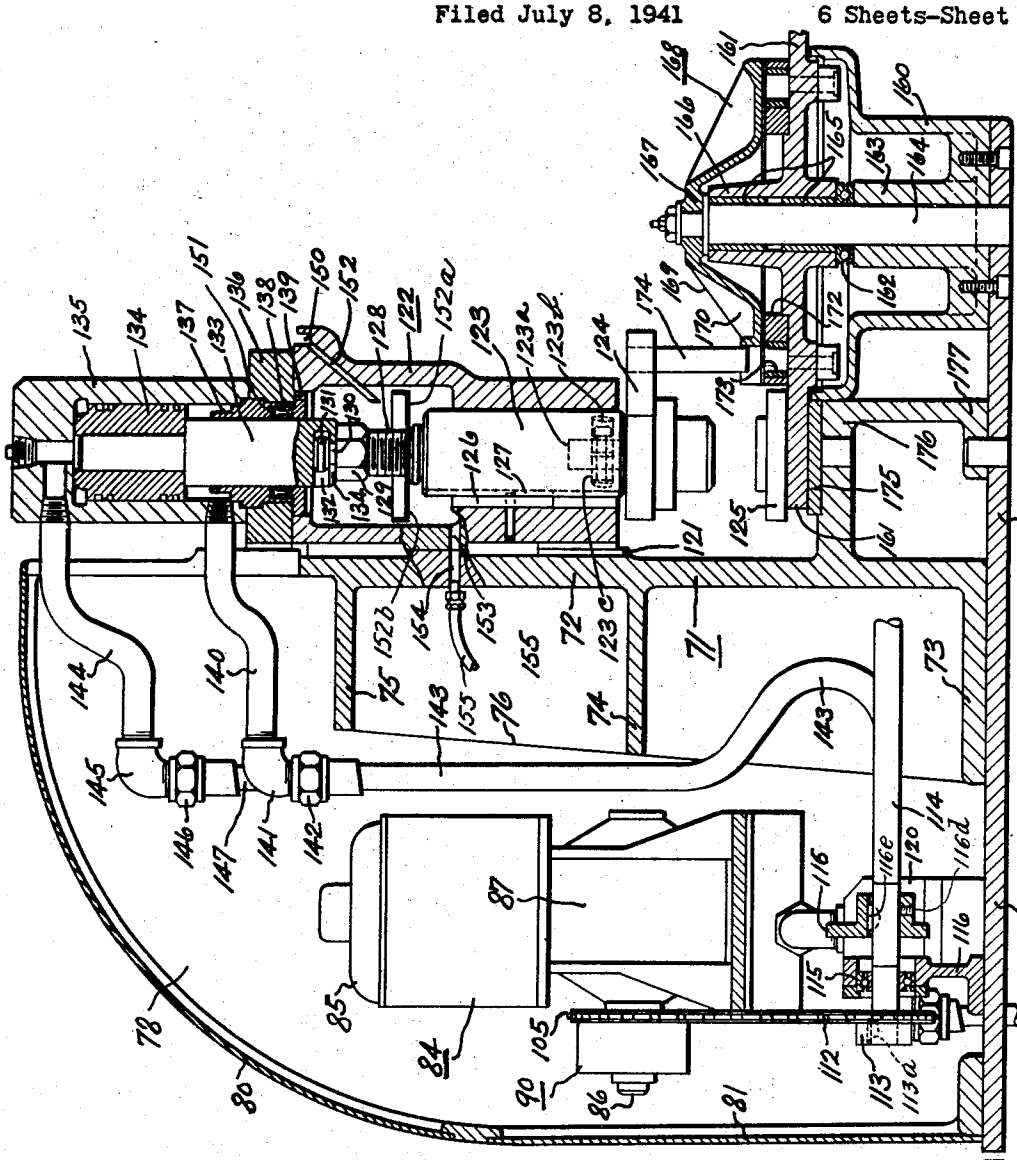

Fig. 4.

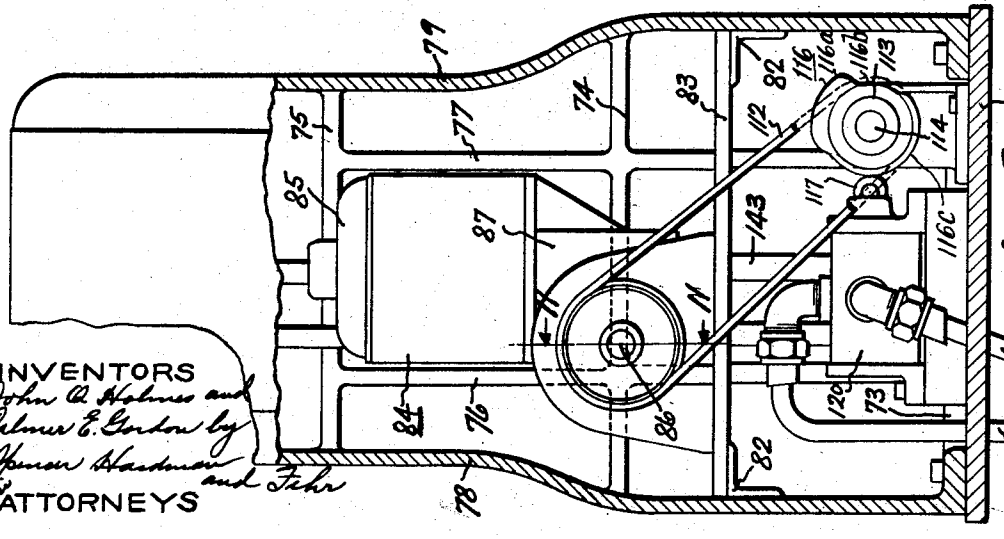

Fig. 5.

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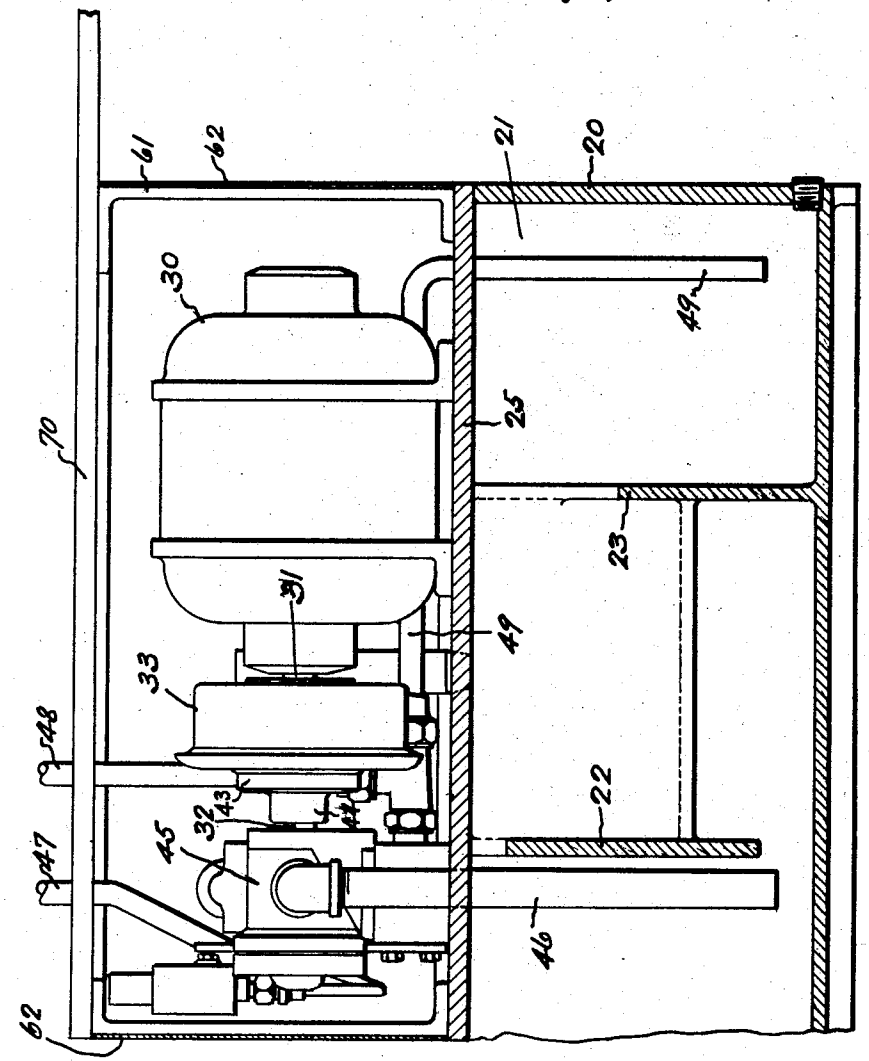

Fig. 6

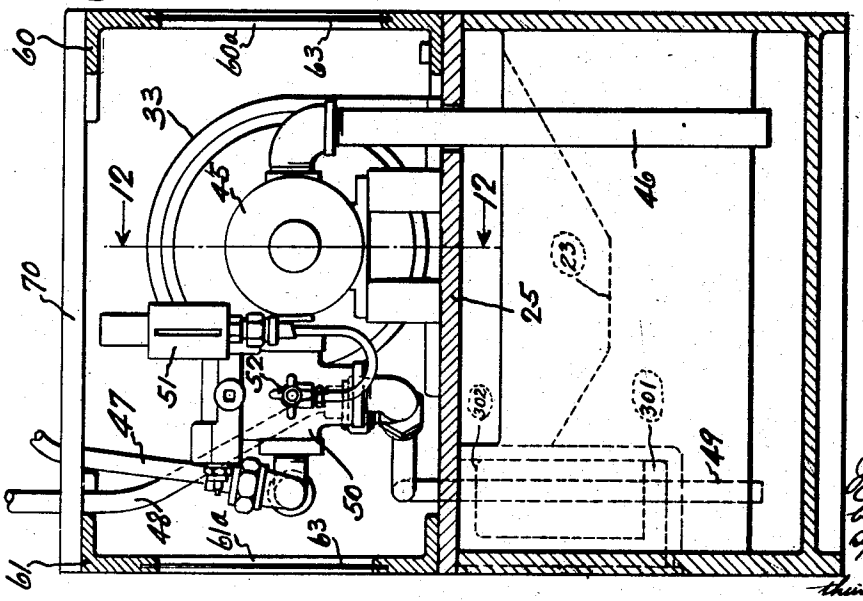

Fig. 7

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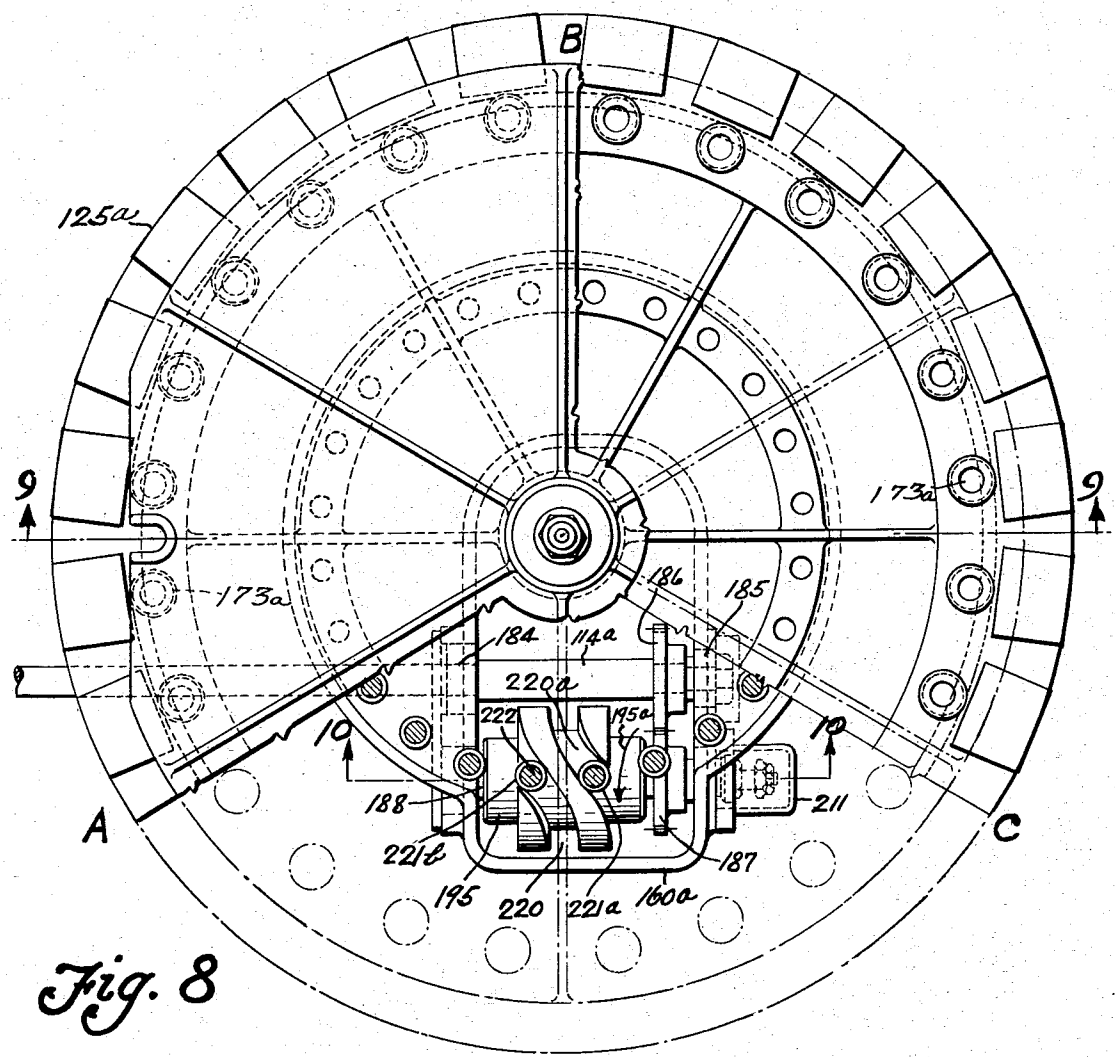

Fig. 8

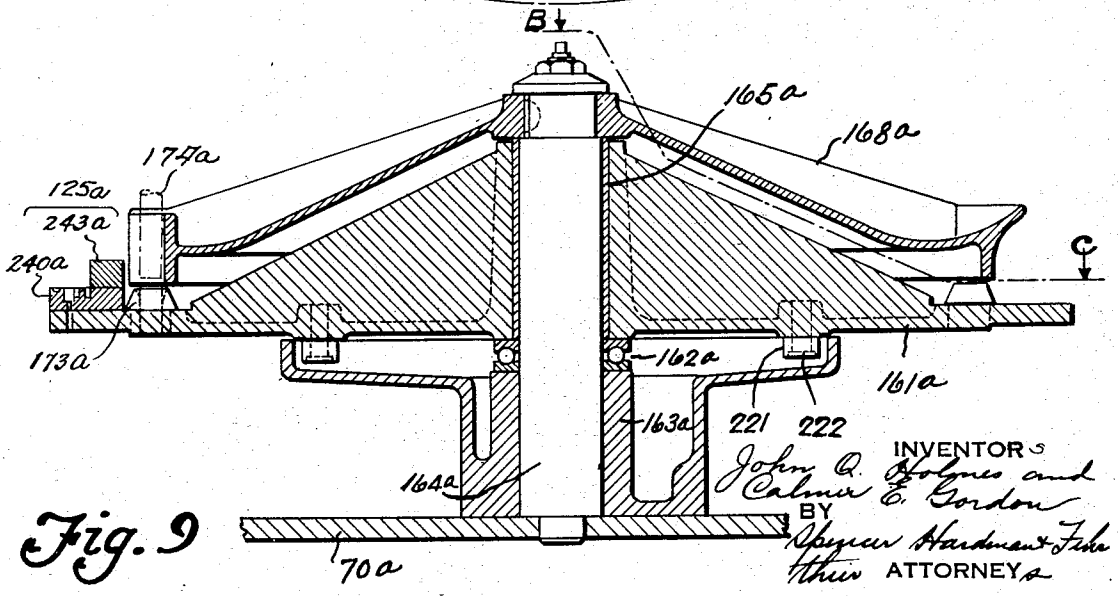

Fig. 9

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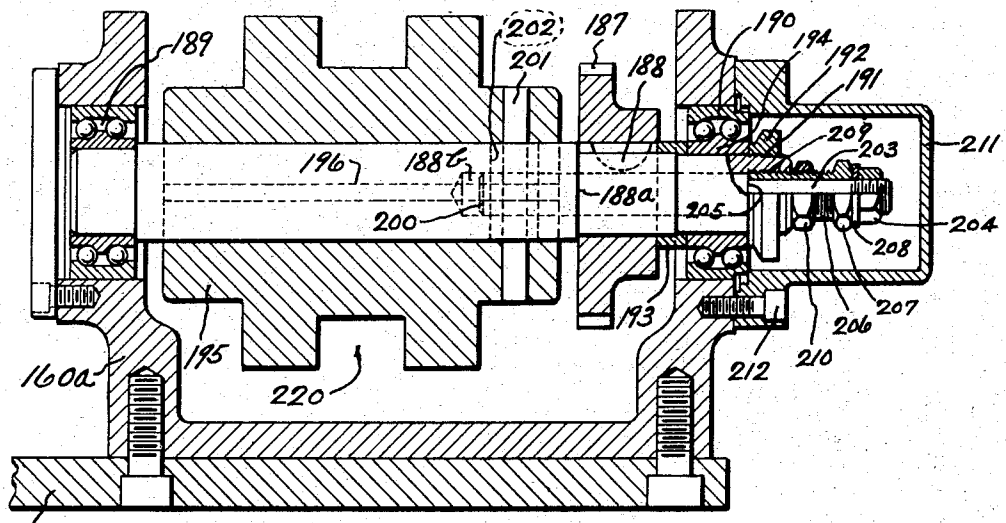

Fig. 10

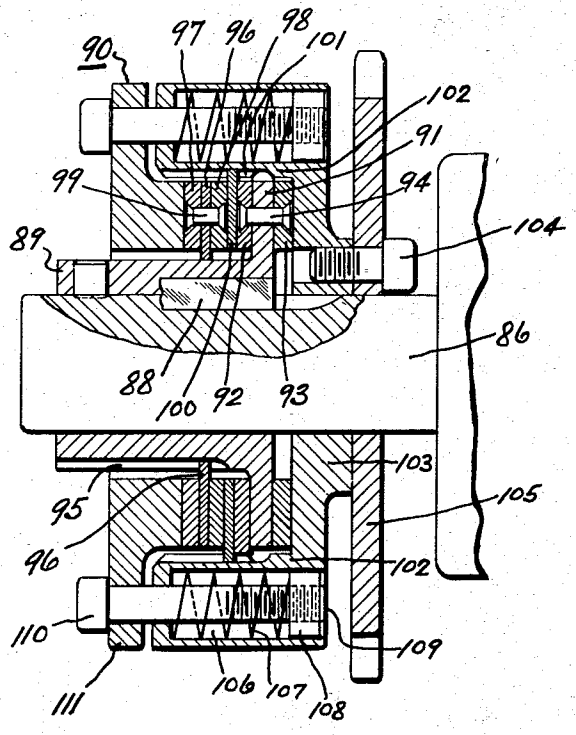

Fig. 11

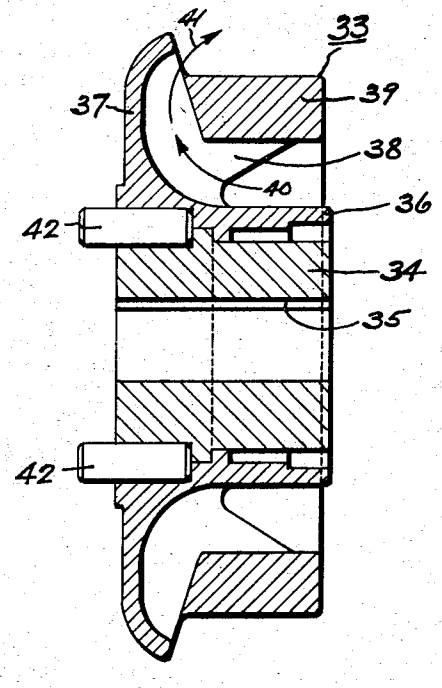

Fig. 12

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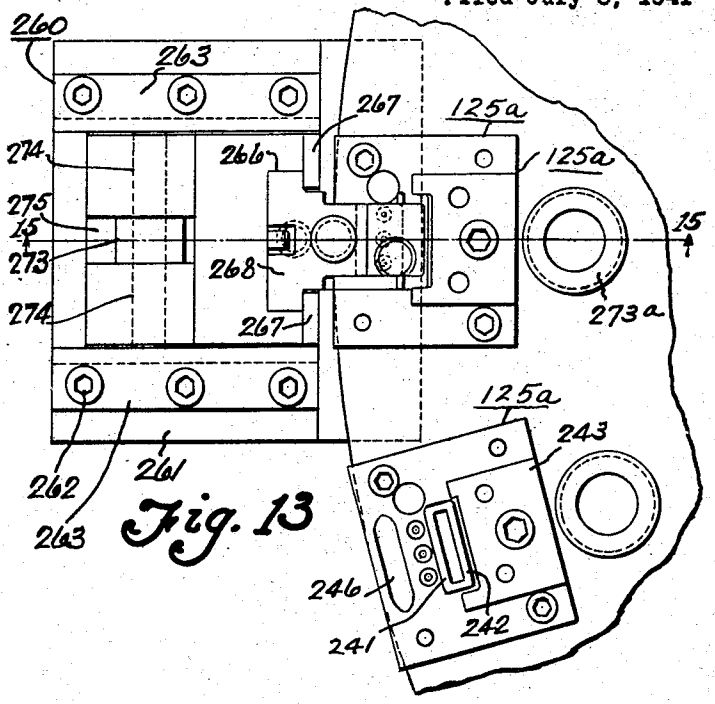

Fig. 13

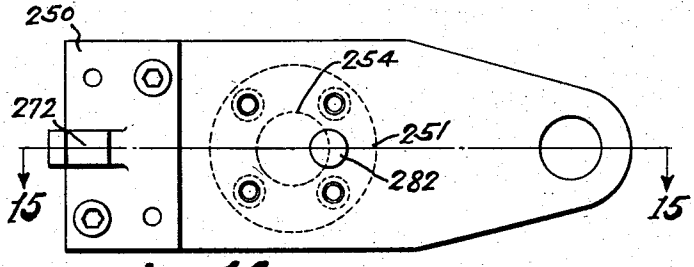

Fig. 14

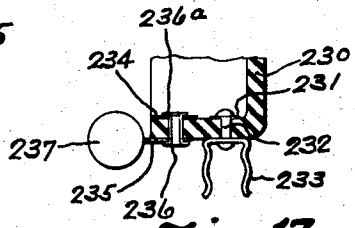

Fig. 17

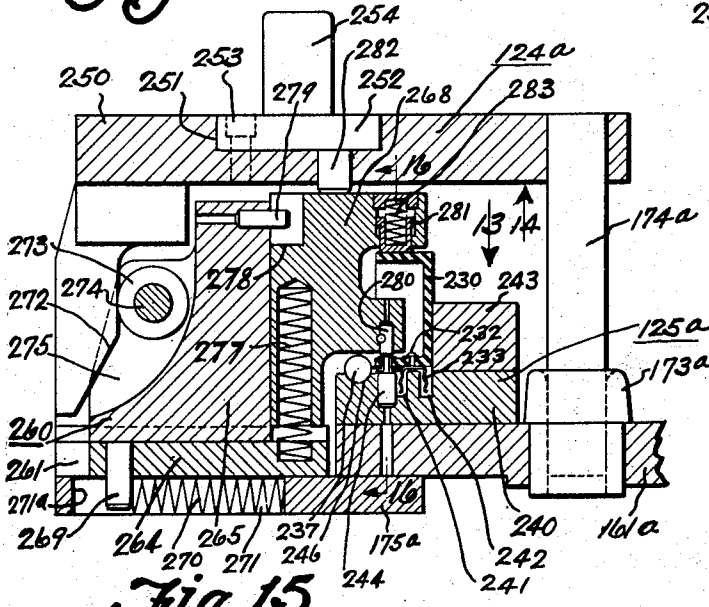

Fig. 15

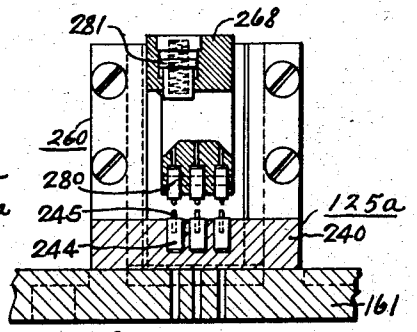

Fig. 16

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Patented May 18, 1943 2,319,232

UNITED STATES PATENT OFFICE

2,319,232

HYDRAULIC PRESS

John Q. Holmes and Calmer E. Gordon, Anderson, Ind., assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application July 8, 1941, Serial No. 401,544

2 Claims. (Cl. 218—1)

This invention relates to hydraulic presses having rotary plate conveyors carrying a plurality of work holders which are automatically moved into position to be operated upon by the ram of the press.

It is an object of the invention to provide a self contained hydraulic press unit of the enclosed type which can be adapted for various kinds of work and operations by the selection of suitable subassemblies of a number of interchangeable subassemblies.

In the disclosed embodiment of the press this object is accomplished by providing a table supported by a base which encloses a reservoir for containing a pressure fluid and a motor drive pressure pump unit mounted over the reservoir. The table supports a pedestal on one side of which is mounted a ram unit providing one or more rams operated by pistons operating in hydraulic cylinders. The table supports a rotary plate conveyor or dial feed which may be one selected from a number of interchangeable dial feed units. The pedestal, which supports the ram unit, provides an enclosure for a dial feed operating mechanism and for a cam operated valve for controlling the admission and the discharge of pressure fluid with respect to the ram cylinder in timed relation with respect to movements of the dial feed. The dial feed operating mechanism and the valve-controlling cam are operated by an electric motor contained within the housing provided by the pedestal.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein two embodiments of the present invention are clearly shown.

In the drawings:

Fig. 1 is a side elevation of an hydraulic press embodying the present invention.

Fig. 2 is a front elevation.

Fig. 3 is a fragmentary side elevation of the press shown in Fig. 1, but with a dial feed of larger diameter than shown in Fig. 1.

Fig. 4 on Sheet 2 and Fig. 6 on Sheet 3, together constitute a sectional view on line 4—4 of Fig. 2.

Fig. 5 on Sheet 2, and Fig. 7 on Sheet 3, together constitute a view in the direction of arrow 5 of Fig. 1 with certain parts of the frame work in section to show the interior.

Fig. 8 is a composite view in the direction of arrow 8 of Fig. 3 and comprises segments AB, BC and CA. Segment AB is a plan view of the dial feed; BC is a sectional view on line BC of Fig. 9; and the segment CA is a sectional view on the line CA of Fig. 3.

Fig. 9 is a sectional view on line 9—9 of Fig. 8.

Fig. 10 is a sectional view on line 10—10 of Fig. 8.

Fig. 11 is a sectional view of a friction clutch unit taken on the line 11—11 of Fig. 5.

Fig. 12 is a sectional view of a flexible coupling and fan unit on line 12—12 of Fig. 7.

Fig. 13 is a fragmentary plan view showing a portion of a rotary conveyor or turntable upon which work holders are mounted. This view shows the lower subassembly of the tool which operates upon the work placed in the workholder. Fig. 13 is a view taken in the direction of the arrow 13 of Fig. 15.

Fig. 14 is a view taken in the direction of arrow 14 of Fig. 15 and shows the underside of the upper subassembly of the tool which operates upon the work.

Fig. 15 is a sectional view on line 15—15 of Fig. 13.

Fig. 16 is a sectional view on line 16—16 of Fig. 15.

Fig. 17 is an enlarged fragmentary sectional view of the assembly of parts which are assembled by the machine.

Referring to Figs. 1 to 7, the machine comprises a base 20 providing a tank 21 divided by baffle walls 22 and 23 (Fig. 6) for containing a hydraulic pressure fluid. These walls tend to eliminate the effects of foaming of the fluid. The tank 20 supports a cover plate 25 providing a base for supporting certain elements of the hydraulic system. One of these elements is an electric motor 30 attached to base 25 and driving a shaft 31 connected with a shaft 32 by a coupling and flywheel fan unit 33 shown in section in Fig. 12. The unit 33 comprises a hub 34 having a keyway 35 for receiving a key by which the hub 34 is connected with shaft 31. The hub 34 supports a sleeve 36 having a flange 37 connected by webs 38 with the flywheel rim 39. The webs 38 are shaped to provide fan blades. During the rotation of the unit 33 air is caused to flow in the direction of the arrows 40 and 41 thereby inducing the flow of air around the motor for cooling purposes. The sleeve is keyed to the hub 34 by a plurality of dowel pins 42 which serve to connect the hub also with a plate 43 integral with hub 44 keyed to the shaft 32.

The shaft 32 turns a rotary pump 45 which withdraws pressure fluid from tank 21 thru a pipe 46 and discharges the fluid under pressure thru a pipe 47 leading to one or more pressure cylinders to be described. The pressure cylinder

discharges thru piping connected thru pipe 48 connected with a return pipe 49 which serves also as a by-pass in case the hydraulic pressure exceeds a certain amount. A by-pass valve 50 connects pump 45 with pipe 47, and automatically opens a by-pass from the pump 45 to the tank 21 thru the pipe 49 when the pressure exceeds a predetermined limit which can be adjusted. The unit 51 is a pressure gauge connected with valve 50 by a hand operated valve 52.

The plate 25 supports two side plates 60 and 61 of channel shaped cross section as shown in Fig. 7. The plates 60 and 61 are joined at both ends by a plate 62, Fig. 2, thereby providing a box-like frame which encloses the motor driven pump 45. The plates 60 and 61 are provided with openings 60*a* and 61*a* respectively, covered by panels of wire mesh 63. Air for ventilating the pump may enter thru the screened openings 60*a* and 61*a*. The frame members 60 and 61 support a platform or table 70 which supports a casting 71 comprising a web 72 integral with horizontal cross ribs 73 and 74 and 75 and vertical cross ribs 76 and 77. The web 72 and the horizontal cross ribs 73—74 and 75 are integral with side walls 78 and 79. As shown in Fig. 4 the upper and left-hand edges of the walls 78 and 79 are shaped so as to receive a curved plate 80 and a flat rectangular plate 81. Thus the web 72 of the casting 71 its side walls 78 and 79 and the plates 80 and 81 provide an enclosure for an electric motor and the mechanism operated thereby for driving the rotary conveyor or dial feed of the machine and for operating the timing cam for controlling a valve which controls the intake and exhaust of pressure fluid with respect to an hydraulic cylinder which operates the pressure ram of the machine.

The walls 78 and 79 provide brackets 82 for receiving a plate 83 which supports a power operated unit 84 comprising an electric motor 85 connected with a shaft 86 thru the medium of speed reducing gearing in a housing 87. As shown in Fig. 11, shaft 86 is connected by key 88 with a sleeve 89 provided with a flange 91 to which friction plates 92 and 93 are attached by a plurality of rivets 94. The sleeve 89 is horizontally splined at 95 to provide a driving connection with a plate 96 to which friction plates 97 and 98 are attached by a plurality of rivets 99. Between the plate 92 and the plate 98 there is located a friction disc 100 having a driving connection to the integrally splined portion 101 of the flange 102 of a disc 103 attached by screws 104 to a sprocket gear 105. The flange 102 is provided with a plurality of sockets 106 each for receiving a spring 107 for exerting pressure toward the right against a nut 108 attached to a screw 109 the head 110 of which bears against a pressure plate 111 bearing against the friction disc 97.

The sprocket gear 105 of unit 90 is connected by a chain 112 with a smaller sprocket 113 keyed to a shaft 114 the left end of which is journalled in a ball bearing 115 supported by bracket 116 attached to table 70 as shown in Fig. 4. Shaft 114 operates a cam 116 for engaging a roller 117 on the end of a horizontal valve-operating reciprocating rod, not shown. A spring, not shown, urges roller 117 toward the right and against the cam 116 having lands 116*a*, 116*b*, and 116*c*. The roller 117 is moved by the cam 116 or by the spring referred to in order to control the operation of a valve 120 with which the pipes 47 and 48 are connected.

The front face of the wall 72 as viewed in Fig. 2 or the right hand face of wall 72, as viewed in Figs. 1 and 4, is provided with a mounting pad 121 which is so shaped as to accommodate any one of a series of castings such as the casting 122 shown in Figs. 1, 2, 3 and 4. The casting 122 provides a guide for a vertically reciprocable ram 123 which is adapted to support an upper tool subassembly 124 for cooperating with a lower tool subassembly 125. The ram 123 is prevented from rotating by a key 126 attached to casting 122 and received in a groove 127 in a ram 123.

Ram 123 receives a screw 128 having a hex head 129. The head 129 is integral with an extension 130 of reduced diameter having a head 131 of larger diameter. Head 131 is received by recess 132 in piston rod 133. The part 130 is received by a notch 134 less in width than the recess or notch 132. By turning the screw 128 the distance between the ram 123 and the rod 133 can be adjusted in order to raise or lower the ram 123 and the tool unit 124 carried thereby when the piston 134 connected with rod 133 is in the lower position. Piston 134 is slidable within a cylinder 135 secured to a block 136 apertured to receive a bushing 137 carrying a liquid sealing ring 138 secured by a plate 139 attached to the block 136. Below piston 134, the cylinder 135 is connected by pipe 140, L 141, union 142 and pipe 143 with valve 120. Above the piston 134, the cylinder 135 is connected by pipe 144, L 145, union 146 and pipe 147 with valve 120.

Referring to Fig. 5, the rotation of cam 116 is counterclockwise. When roller 117 rides on the land 116*a* of cam 115, valve 120 is so conditioned that pressure fluid is admitted through the pipes 147 and 144 to the upper end of cylinder 136 while the lower end of the cylinder is connected by pipes 140 and 143 with the exhaust port of valve 120 connected by pipes 48 and 49 with the reservoir 21. When the roller 117 rides on the land 116*b* conditions are reversed so that pressure fluid will be admitted to the lower end of cylinder 135 while the upper end will be connected with exhaust. When the roller 117 rides on land 116*c*, pressure fluid is trapped in the lower end of cylinder 135 and the output of the pump passes under low pressure to the reservoir. While the roller 117 is riding on the land 116*c*, the shaft 114 operates a mechanism for rotating a rotary conveyor or dial feed to be described.

The casting 122 is provided with a groove 150 for receiving any oil that may leak through the packing 151 between the cylinder 135 and the block 136. A tube 152 conducts the oil from groove 150 to a pan 152*a* (attached to rod 128) which also receives any oil which may leak past the packing 138. Oil caught by the pan 152*a* passes through a hole 152*b* and then through a passage 153 of the casting 122, through a passage 154 of casting 73, and through a drain pipe 155 leading to the reservoir.

As stated before, casting 122 may be one of a series of interchangeable castings, any one of which may be secured to the frame 71. Other castings performing the function of 122 may be constructed so as to support a plurality of rams 123 and operating cylinders in case it is desired to perform a plurality of operations simultaneously upon work carried by a plurality of workholders carried by the conveyor. In case the machine is provided with a plurality of cylinders 135, the pipes 143 and 147 would be connected respectively with distributing manifolds instead of the single pipes 140 and 144. One manifold would distribute pressure fluid to the lower por-

tions of all of the cylinders and the other manifold to the upper portions. These manifolds with their branch pipes would be enclosed within the housing walls 72, 78 and 79.

Referring to Figs. 1 and 2, it will be seen that the shaft 114 extends to the right of the frame 71 and into a gear housing provided by a casting 160 supported by the table 70. Shaft 114 drives a mechanism within the housing 160 for effecting the intermittent step-by-step rotation of a rotary conveyor or dial feed turntable 161 which carries a plurality of workholders each provided by a lower tool unit 125 cooperating with the upper tool unit 124. In Fig. 1 only one pair of tool units 124 and 125 is illustrated. The turn table 161 may be provided with as many as 14 of these particular units. The particular mechanism for intermittently rotating the table 161 is not shown but it is similar to mechanism to be described in connection with the description of the mechanism for rotating a turntable of larger diameter than the turntable 161. For present purposes it is sufficient to state, referring to Fig. 4, that the table 161 is supported by a step bearing 162 resting on a tubular boss 163 integral with the housing 160. A stationary shaft 164 fixed to boss 163 extends upwardly through the step bearing 162 and provides a journal engaged by bearings 165 fixed to the hub 166 of the table 161. To the upper end of shaft 164 is secured the hub 167 of a tray 168 divided by integral ribs 169 into a plurality of compartments 170. The turn table 161 supports a ring 172 carrying a plurality of hard metal insert bushings 173, there being one bushing for each workholder 125. As there may be some slight lost motion in the mechanism for indexing the turntable 161, it is necessary to bring each workholder 125 into perfect alignment with the upper tool assembly 124. Therefore the upper tool unit 124 is provided with a pilot rod 174 which enters a bushing 173 when the tool unit 124 descends. The entrance end of bushing 173 is slightly tapered so that, when the rod 174 descends, the lower end of rod 174 will cooperate with bushing 173 in such manner as to shift the table 161 slightly in order to align a workholder or lower tool unit 125 with the upper tool unit 124.

In order to transmit the force applied by the upper tool unit 124 to the work and thence to the lower tool unit 125 carried by the turn table 161, that portion of the turntable 161 carrying work being operated upon by the tools rides over the plane surface of a plate 175 supported by a knee 176 integral with the frame casting 71 and integral with a foot 177 resting on the table 70.

The housing 160 and parts carried thereby including the table 161 and the tray 168 constitutes a unit which may be one of several interchangeable units with which the machine may be equipped. Another of these turntable units is shown in Fig. 3 wherein the housing is 160*a* and other parts similar in character to those shown in Fig. 4 are numbered with similar reference numerals with the affix *a*. The turntable 161*a* is intended to carry as many as thirty-six workholders 125*a*. Since its diameter is much greater than the diameter of turntable 161, it is necessary to use a longer table 70. Since a substantial portion of said longer table 70 extends out beyond the base of the machine the right end of table 70 is provided with a bracket 180 connected by a tubular strut 181 with a bracket 182 attached to the base 20. Since the center of the table 161*a* is spaced from the frame 71 at a distance greater than the distance between the center of table 161 in frame 71, it is necessary to use a longer shaft 114*a*, Fig. 3.

The mechanism for intermittently rotating the table 161*a* will now be described with reference to Figs. 8, 9 and 10. Housing 160*a* provides bearings at 184, 185 for shaft 114*a* which drives a gear 186 meshing with a gear 187 keyed to a shaft 188 (Fig. 10). Shaft 188 is journalled in bearings 189 and 190 provided by the housing 160*a*. The right hand portion of the shaft 188 is tubular and is externally threaded at 191 to receive a nut 192 which when tightened causes the following parts to be gripped between the nut 192 and a shoulder 188*a* of shaft 188, namely: the hub of gear 187, a spacing sleeve 193 and the inner race 194 of ball bearing 190. The shaft 188 supports and drives a cam unit 195 having a longitudinal spline connection with shaft 188 as indicated at 196. The cam unit 195 can be adjusted longitudinally along the shaft and locked in the desired position of adjustment. For this purpose the central bore 188*b* of shaft 188 receives a rod 200 connected with the cam unit 195 by a cross pin 201 extending through a transverse slot 202 provided in the shaft 188. Rod 200 is provided with a portion 203 of reduced diameter threaded to receive a nut 204. When the nut is tightened the following parts are clamped between the nut and a shoulder 205 of the rod 200, namely: an externally threaded sleeve 206 having a hex head 207 and a washer 208. When the nut 204 is slightly loosened, the threaded sleeve 206 may be turned. Since this sleeve is threadedly connected at 209 with the shaft 188, rotation of the sleeve 206 by applying a wrench to its head 207 will cause the rod 203 to move axially and relative to the shaft 188. This will cause the cam unit 195 to be moved longitudinally with respect to shaft 188. When the cam 195 has been located in the desired position of adjustment a nut 210 threaded on the sleeve 206 can be tightened down against the right end of shaft 188 and the nut 204 can be tightened against the washer 208 and the latter against the hex head against sleeve 206. In this way, the rod 203 is secured in the desired position of adjustment with respect to the shaft 188. The adjusting parts including the nut 192, the nut 210, the hex head 207 and the nut 204 are enclosed by a cup shaped housing 211 secured to the housing 160*a* by a plurality of screws 212.

The cam unit 195 is provided with a cam groove 220 for receiving cam follower rollers 221. Each roller 221 is mounted on a pin 222 attached to turntable 161*a*. The cam groove 220 is so shaped that the table 161*a* is moving during about one-half revolution of shaft 114*a* and shaft 188 and is stationary for about one-half revolution. The cam 195 is so related to the cam 116 (Fig. 5) which controls the valve 120 that, while the table is stationary the ram 123 moves downwardly to cause an operation to be performed on the work piece and then the ram returns to upward position. As the cam 195 is viewed in Fig. 8, it will be seen that one of the rollers 221*a* is entering the groove 220 while an adjacent roller 221*b* is moving from the groove, rotation of cam 195 being in the direction indicated by arrow 195*a*. By the time the roller 221*a* has arrived at the noncamming part of the groove indicated at 220*a* the table 161*a* will have been moved into such position that a workholder 125*a* will have been brought into alignment with the tools controlled by the ram of the press or at least into such po-

sition that the bushing 173a Figs. 3 and 15 is in alignment with the pilot rod 174a attached to the upper member of the tool unit. In order to make this alignment as perfect as possible the cam 195 is adjustable along the shaft 188 by the means which has been described with reference to Fig. 10.

The mechanism which is employed for indexing the smaller turntable 161, Figs. 1 and 2, is substantially the same as the mechanism shown in Fig. 8, for indexing the larger turntable 161a. When the machine is equipped with the smaller turntable 161 having only 14 workholders there will be only 14 rollers 221 supported by pins 222. Obviously these pins 222 will be much closer to the axis of the shaft 164 than is shown in Fig. 8. In that case the cam 195 can be mounted directly on the shaft 114 and the countershaft 188 can be omitted. As is the case with the machine shown in Fig. 4 equipped with the smaller table 161, the shaft 164a which provides a journal for the larger table 161a, also supports a tray 168a for containing articles which are to be assembled by the machine.

As an example of the kind of work which the machine is adapted to perform, reference is made to Figs. 15 and 17 in which numeral 230 designates a case made of Bakelite for an electric switch. Within the case is located a conductor strap 231 electrically connected and mechanically secured by a rivet 232 with a clip 233 for receiving a cartridge fuse. These parts have been assembled on a separate machine. The purpose of the tools shown in Figs. 13, 14 and 15 is to assemble with the case 230 three contact straps 234, three terminal clips 235 and three connecting, tubular rivets 236. The terminal clips 235 are a part of a resistance unit 237 used for controlling the speed of the smaller electric motor such as the defroster motor or the heater motor of an automobile. The function of the machine is to set the three tubular rivets 236 by a single stroke of the press plunger or ram 123.

In Fig. 8 each work holder unit 125a is represented merely by a rectangle. This workholder unit 125a will now be described in detail with reference to Figs. 13 and 15. It comprises a base block 240 having grooves 241 and 242 for receiving the prongs of the fuse clip 233 when the switch case 230 rests upon the block 240. As shown in Fig. 15, the vertical outer face of the switch case 230 engages a vertical face of a block 243 attached to block 240. Block 240 supports three riveting anvil pins 244 each having a projection 245. Upon each of the anvils 244 there is placed, flange down, a tubular rivet 236 the upper end of which has not yet been upset. Each pin 245 will project thru the opening of a rivet. Then the three terminal clips 235, previously apertured to receive the rivets, will be placed around the rivets with the main part of the unit 237 resting in a groove 246 provided by block 240. Then the switch case 230 will be placed in position, each of three holes pre-formed in the case 230 receiving a rivet 236. Then contact straps 234, located within the case 230 are each placed around the upwardly projecting end portions of the rivets 236.

The manipulation of the workpieces from which the switch assembly is made, is performed by the operators of the machine who are located at one side of the turntable 161a and load the workholder units 125a in advance of movement thereof between the tools which will now be described.

In the form of tools shown in Fig. 15 the upper tool unit 124a corresponds in function to the upper tool unit 124 of Fig. 1. It comprises a plate 250 counterbored at 251 is receive a disc 252 secured to the plate by screws 253. From disc 253 there extends upwardly a rod 254 which (as shown in Fig. 4) is received within a recess 123a in the ram 123 and is secured by a screw 123b and a wedge nut 123c. To the plate 250 is attached the pilot rod 174a for engaging the pilot bushings 173a of table 161a. Riveting pressure is not exerted directly upon the rivets 236 by the plate 250 but thru the interposition of a mechanism included in a riveting unit 260.

The unit 260 comprises a base 261 to which screws 262 secure two parallel bars 263 providing ways for the guidance for a sliding plate 264 supporting a bracket 265 grooved at 266 and carrying plates 267 thus providing ways for the vertical sliding movement of a block 268. The base 264 is provided with a downwardly projecting pin 269 engaged by a spring 270 occupying a slot 271 in a pressure plate 175a corresponding in function to plate 175 of Fig. 4. Plate 264 and bracket 265 and block 168 are caused to move into position shown in Fig. 15 against the action of spring 270 by the cooperation of a cam bar 272 carried by plate 250 with a roller mounted on a rod 274 and occupying a slot 275 in bracket 265. When the plate 250 is in upper position the pilot pin 174a will clear the bushing 173a and the cam 272 will have moved so far upwardly that the pin 269 will be urged by spring 270 against a stop surface 271a at the left end of slot 271. At the same time the block 268 will have been urged upwardly by spring 277 until a stop surface 278 engages a pin 279 carried by the bracket 265. Therefore, when the plate 250 is in the upper position, the portion of the bracket 268 and parts carried thereby which are adjacent the switch case 230 will be so spaced from the case 230 that the case may be moved adjacent to bracket 268 by the turntable without interference. During downward movement of plate 250 the cooperation of cam 272 with roller 273 causes riveting anvils 280 carried by block 268 to be brought into alignment with the riveting anvils 244 of block 240 and with the rivets supported thereon; and a spring urged pressure pad 281 will be located above the upper side of the box 230. Following this movement of the block 268, a pin 282 carried by the disc 252 will engage the block 268 to cause it to move downwardly to the position shown so that the pressure pad 281 will be urged by a spring 283 against the top of the box 230 to hold the assembly in position while the riveting anvils 280 engage the rivets 236 to swedge their upper ends over against the contact straps 234 as indicated at 236a in Fig. 17. Following the riveting operation and while the turntable 161a is stationary, the plate 250 is caused to return automatically to its upper position under the action of fluid pressure thereby permitting block 268 to move upwardly and the bracket 265 to move toward the left from the position shown in Fig. 15 so that the turntable 161a is free to move the riveted assembly of switch case 230 and other parts away from the riveting tools and to move the succeeding unriveted assemblies into position for operation by these tools.

The tool units shown in Figs. 13 to 17 are merely illustrative of the types of work which may be carried out by hydraulic riveting presses. Quite obviously the tools will vary according to the change of the work. However, it is apparent

that each of these tools will generally comprise an upper member adapted to be secured to the ram of the hydraulic press and a lower member including a work holder mounted on the turn table. The two members **124** and **125** may directly cooperate as shown in Fig. 1, or indirectly thru the interposition of a unit such as **260** in Fig. 15. Some types of work requires operations to be performed in steps. If there are two steps to be performed the machine can be equipped with two hydraulically operated tool units which perform operations simultaneously upon work carried by the lower tool units or work holders. The machine may be equipped with a bank of three hydraulically operated rams carrying three different upper tool units for performing a progression of operations upon work assemblies mounted upon lower tool units or work holders.

The pump motor **30** and the turntable motor **85** are started and stopped from either side of the machine by push buttons **300** (Fig. 1). The base **20** provides a pocket **301** (Fig. 7) for housing an overload circuit breaker unit **302** which protects the motor **30**. The unit **302** is reset by a push button **303** (Fig. 1). While the motors **30** and **85** are operating, the turn table **161** of Fig. 1, or **161***a* of Fig. 9, rotates intermittently to carry the work pieces located on the work holders **125** of Fig. 1 or **125***a* of Fig. 15 successively under the tool operating ram **123** which is caused to move down and up while the turn table is stationary. The loading of the work holders and the removal of assembled parts from the work holders can be carried on while the turn table is moving as well as when it is stationary.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A hydraulic press comprising, a base; a frame supported by the base and providing a housing; a ram sub-assembly detachably mounted upon its frame and exterior to the housing and comprising a vertically movable, tool supporting ram, a piston connected with the ram and a fluid pressure cylinder receiving the piston; a dial-feed sub-assembly detachably mounted upon the base and comprising a turn-table for carrying a plurality of work holders adjacent to the ram and the tool carried thereby, and comprising a mechanism for intermittently rotating the turn-table; and a motor-operated mechanism located within the frame housing and operatively connected with the turn-table rotating mechanism and including a cam-operated valve for controlling the passage of pressure fluid into the cylinder of the ram unit and the exhaust of said cylinder in timed relation to movements of the turn-table of the dial feed.

2. A hydraulic press comprising, a base providing a tank for pressure fluid; a base cover; a housing supported by the cover; a motor-driven fluid pressure pump located within the housing and supported by the cover; a table supported by the housing; a frame supported by the table and having a vertical wall intermediate the ends of the table and providing a housing at one side of the wall; a ram sub-assembly detachably mounted upon the frame wall and exterior to the housing provided by the frame, said sub-assembly comprising a vertically movable, tool supporting ram, a piston connected with the ram and a fluid-pressure cylinder receiving the piston; a dial-feed sub-assembly detachably secured to the table and comprising a turn-table for carrying a plurality of work holders adjacent to the ram and the tool carried thereby, and comprising a mechanism for intermittently rotating the turn-table and a drive-shaft extending from the dial-feed unit and into the housing provided by the frame above the table; and a motor driven mechanism located within the frame-housing for driving the shaft and including a cam mounted on the shaft for controlling the valve in timed relation to operation of the dial feed.

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