

Sept. 5, 1944.

R. T. CORNELIUS

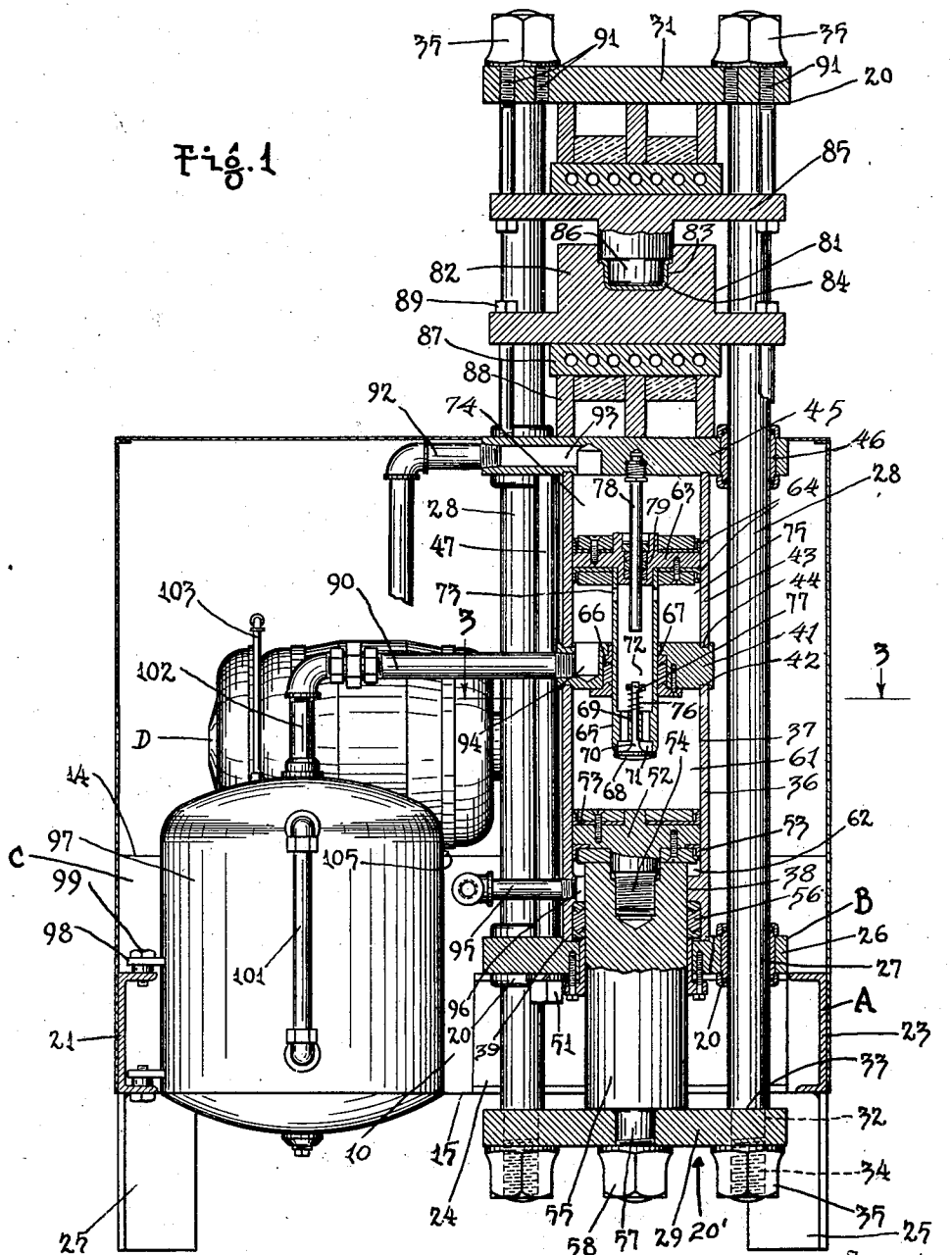
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HYDRAULIC PRESS

Filed Aug. 11, 1941

5 Sheets-Sheet 1

Fig. 1



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Fig. 2

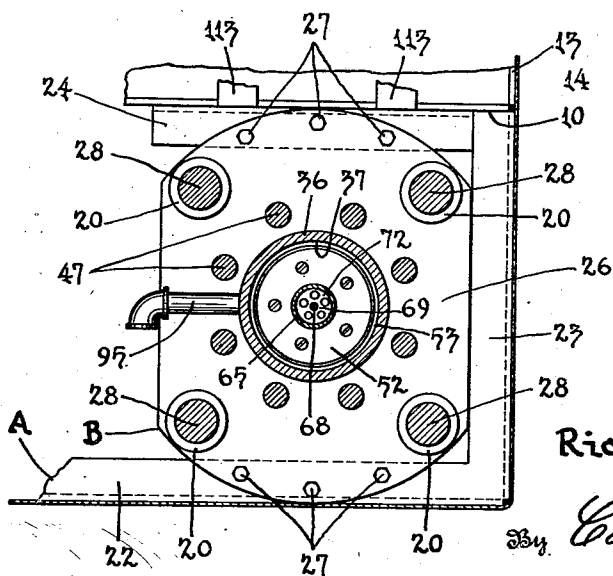
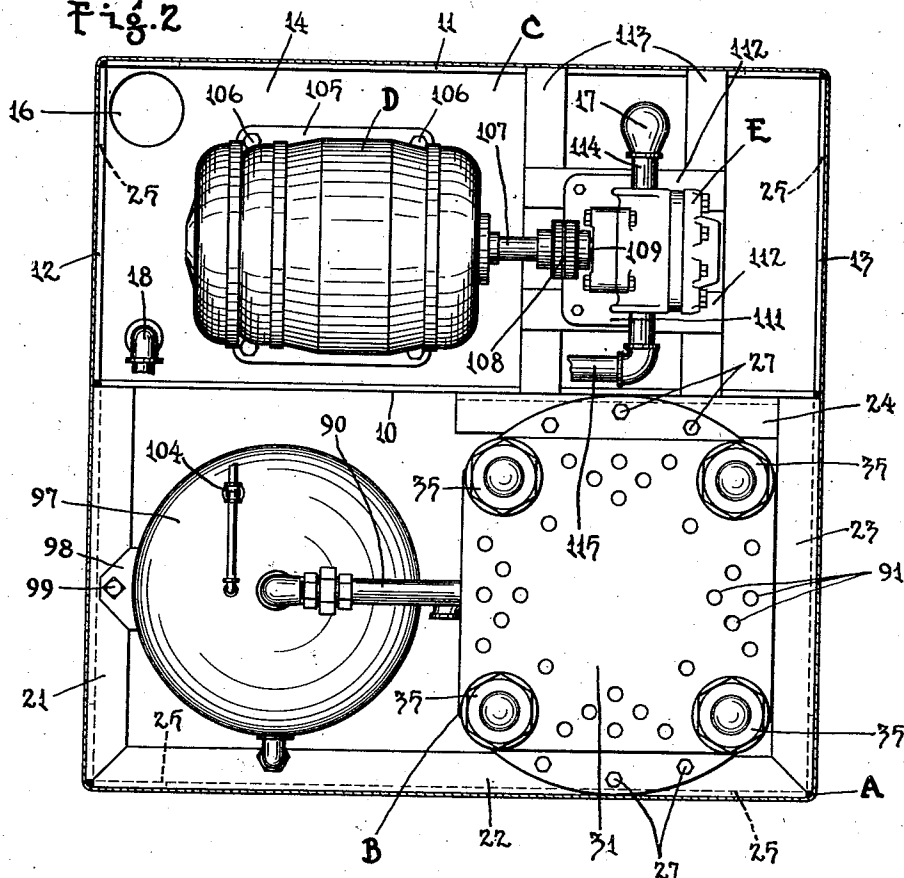


Fig. 3

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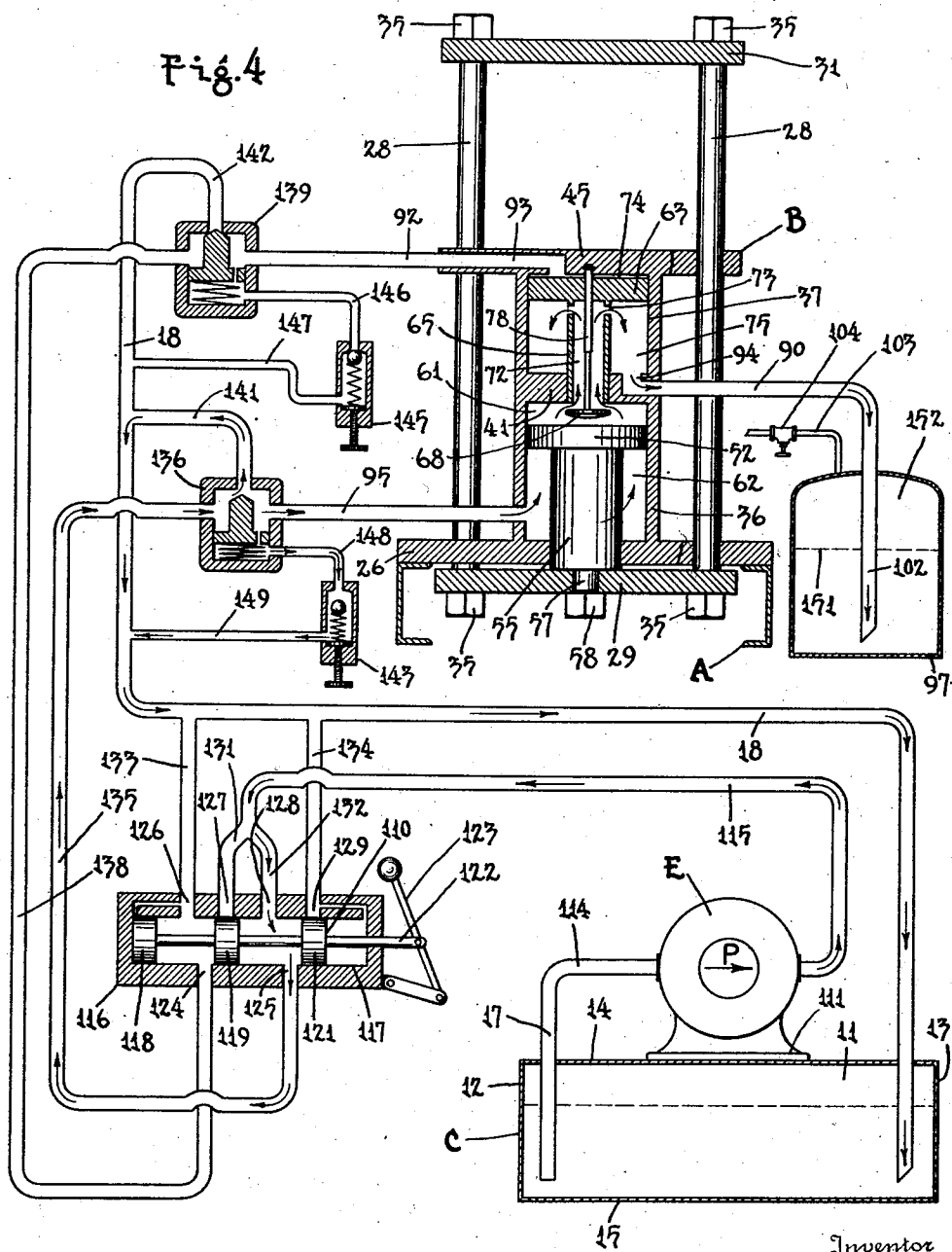
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HYDRAULIC PRESS

Filed Aug. 11, 1941

5 Sheets-Sheet 3



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Sept. 5, 1944.

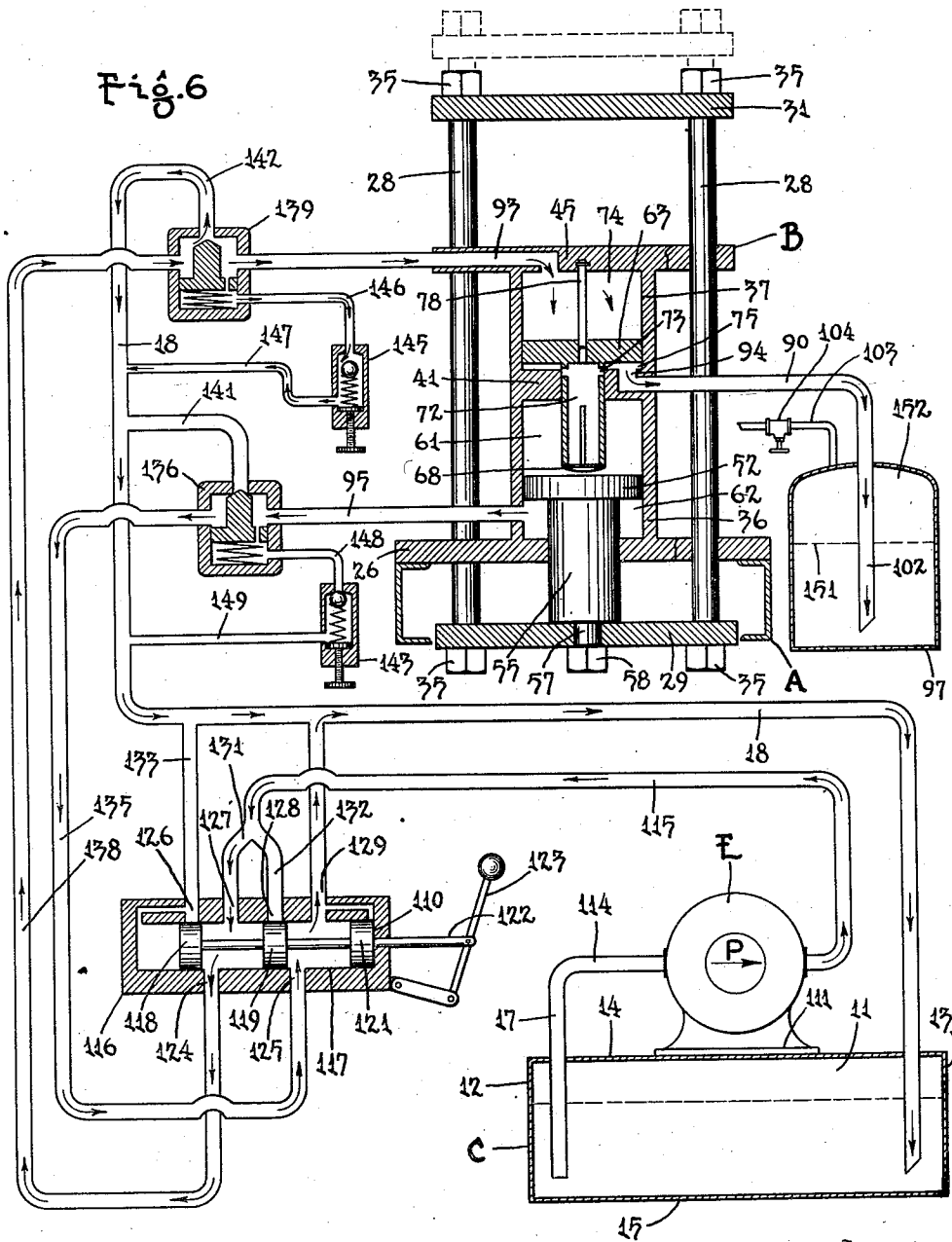
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HYDRAULIC PRESS

Filed Aug. 11, 1941

5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,357,632

HYDRAULIC PRESS

Richard T. Cornelius, Minneapolis, Minn.

Application August 11, 1941, Serial No. 406,342

14 Claims. (Cl. 60—54.5)

My invention relates to hydraulic presses and has for an object to provide a hydraulic press capable of exerting an extremely high pressure.

Another object of the invention resides in providing a hydraulic press utilizing a single rotary pump for procuring the liquid under pressure employed to operate the press.

An object of the invention resides in providing a hydraulic press having a press cylinder and a piston therein for procuring relative movement between the press platen and bed and in providing means for exerting different degrees of pressure in said press cylinder to procure rapid initial travel and slower final travel with greater pressure.

Another object of the invention resides in providing a pump cylinder adapted to communicate with said press cylinder and having a pump piston therein and in further providing a high pressure cylinder having a high pressure piston therein connected with the pump piston and operated thereby.

A feature of the invention resides in providing a reservoir having a gas and a liquid therein under pressure communicating with the pump cylinder on one side of said pump piston for causing return movement of the high pressure piston.

An object of the invention resides in maintaining said reservoir in communication with the pump cylinder at all times.

Another object of the invention resides in providing a passageway between said portion of the pump cylinder to which the reservoir is connected and the press cylinder whereby the liquid under pressure in said reservoir causes relative movement between platen and bed toward each other.

An object of the invention resides in providing valve means in said passageway and in providing means controlled by movement of the pump cylinder for actuating said valve means.

Another object of the invention resides in providing means for connecting the motor-driven pump with the pump cylinder on the other side of the pump piston for procuring movement of said pump piston to cause the high pressure piston to compress the liquid in the press cylinder.

An object of the invention resides in providing means operated by the motor-driven pump for moving said press piston in said press cylinder to procure relative movement between the platen and bed away from each other.

A feature of the invention resides in arranging

the passageway between the press cylinder and the pump cylinder through the high pressure piston and in providing a valve at the end of the high pressure piston for closing said passageway.

A feature of the invention resides in providing a plunger fixed relative to the pump cylinder and passing through the pump piston, said plunger operating to engage the valve and open the same upon the pump piston reaching one of its extreme positions.

Other objects of the invention reside in the novel combination and arrangement of parts and in the details of construction hereinafter illustrated and/or described.

In the drawings:

Fig. 1 is an elevational sectional view of a hydraulic press illustrating an embodiment of my invention.

Fig. 2 is a plan view of the invention.

Fig. 3 is a fragmentary plan sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a diagrammatic view of the invention showing the parts arranged in certain positions.

Fig. 5 is a view similar to Fig. 4, showing the parts in altered positions.

Fig. 6 is a view similar to Figs. 4 and 5 showing the parts in still different positions.

My invention comprises a frame work A on which is supported a hydraulic press B embodying the principal features of the invention, a tank C and an electric motor D driving a pump E. These various parts will now be described in detail.

The tank C is constructed of heavy sheet material having side walls 10 and 11, end walls 12 and 13, a top 14 and a bottom 15. These various parts are secured together by welding at the corners to provide a rigid and substantial construction. At one end of the tank is provided a filler cap 16 which is disposed near the corner between the walls 11 and 12. Near the wall 11 is arranged an outlet pipe 17 which extends down into the tank and which is provided with a strainer (not shown) by means of which the liquid used in the system is cleared of impurities before entering the press proper. At the corner between the walls 10 and 12 is provided a return pipe 18 by means of which the oil discharged from the press is returned to the tank C.

The tank C forms part of the framework A of the invention, being constructed of substantial rigid material to serve the desired purpose. The framework A further consists of three horizon-

tally extending channel-shaped frame members 21, 22 and 23 which are welded together at the corners. The ends of the frame members 21 and 22 are welded to the wall 10 of the tank C. A fourth horizontally extending frame member 24 is also welded to the wall 10 of tank C and lies parallel with the frame member 22. The framework A is supported on four legs 25 which are welded to the frame members 21, 22 and 23 and to the bottom 15 of the tank C at the outer-most corners thereof.

The hydraulic press proper consists of a planiform base 26, best shown in Fig. 3, which rests upon the uppermost flanges of the frame members 22 and 24 and which is secured thereto by means of bolts 27. The base 26 is provided with four vertically extending guides 20 in which are slidably mounted four posts 28, the posts 28 extending throughout the length of the machine. These posts are attached at their lower ends to a cross head 29 and at their upper ends to the platen 31 of the press. This is accomplished by reducing the ends of the post 28, as indicated at 32 to form shoulders 33 which butt against said cross head and platen, said ends being threaded as designated at 34 to receive nuts 35 which clamp the parts and hold the said cross head and platen against the shoulders 33. This assembled structure forms the ram of the press which is indicated by the reference numeral 20.

Mounted on the base 26 is a cylinder 36 which is constructed with a bore 37 at one end of a certain diameter and with a bore 38 at its other end of a somewhat reduced diameter. Said cylinder is received within a recess 39 in the base 26. A cylinder head 41 rests upon the upper end of the cylinder 37 and is constructed with a groove 42 in which the upper edge of the wall of the said cylinder is received. This cylinder head also forms the base for another cylinder 43 which superimposes the cylinder 37 and is concentrically arranged relative thereto. The cylinder 43 is received within a groove 44 formed in the upper surface of the cylinder head 41. The upper end of the cylinder 43 is closed by means of the bed of the press which is indicated by the reference numeral 45. Extending between the bed 45 and the base 26 are a number of tie rods 47 which tie the entire structure together and maintain the cylinders and the parts connected therewith in proper relation. These rods are threaded at their upper ends to screw into the bed 45 and are threaded at their lower ends to receive nuts 51 which draw the parts securely together. The cylinder 37 forms the press cylinder for procuring relative movement between the bed 45 and platen 31, while the cylinder 43 constitutes a pump cylinder for increasing the pressure within the cylinder 37 in a manner to be presently described in detail.

The bed 45 of the press is provided with four guides 46 similar to the guides 27 which receive the posts 28. These guides together with the guides 20 support the ram 20' of the press for movement. Both the bed 45 and the platen 31 are formed with tapped holes 91 into which suitable bolts may be screwed to attach the die members to the same.

Slidably mounted within the cylinder 36 is a piston 52 provided with cup leathers 53 which form in conjunction with the bore 37 of cylinder 36 a fluid-tight connection. This piston is constructed with a stem 54 which screws into a stout piston rod 55 which fits closely within the bore 38 of cylinder 36. A tight joint is affected

between the cylinder 36 and the piston rod 55 by means of a stuffing box 56. The piston rod 55 is provided with a stem 57 which passes through the cross head 29 and which receives a nut 58 by means of which the said piston rod is securely attached to the cross head 29. By means of this construction, a chamber 61 within the cylinder 36 is provided which is disposed upon the upper side of the piston 52. When fluid under pressure is directed into this chamber, the piston 52 travels downwardly, procuring relative movement between the platen 31 and the bed 45 toward one another. At the same time a chamber 62 is formed on the under side of the piston 52 and encircling the piston rod 55, which chamber is of considerably smaller dimensions than the chamber 61. When fluid under pressure is directed into this chamber, the piston 52 rises and relative movement between the platen 31 and the bed 45 is had in a direction away from one another. For the sake of convenience, I have referred to the chamber 61 as the power chamber of the press cylinder and the chamber 62 of said cylinder as the return chamber of the cylinder.

Within the cylinder 43 is slidably mounted a pump piston 63. This piston is constructed with cup leathers 64 by means of which a tight joint is had between the piston and the bore of said cylinder. Attached to the piston 63 is a high pressure piston 65 which passes through the cylinder head 41. A stuffing-box 66 mounted on the cylinder head 41 and encircling the piston 65 forms a fluid-tight connection between said piston and the cylinder head 41. The bore of said stuffing-box through which the piston 65 operates, constitutes a high pressure cylinder which I have indicated by the reference numeral 67 and in which the said piston 65 operates. The piston 63 divides the interior of the cylinder 43 into a chamber 74 which is disposed above said piston and which I have termed the power chamber of the said cylinder. In addition, the said piston forms an annular chamber 75 within the cylinder 43 encircling the piston 65 and disposed below the piston 65. This chamber I have termed the return chamber of the pump cylinder.

In the bottom of the piston 65 is provided a poppet valve 68 which is slidably mounted in a guide 69 formed in the piston 65. This piston has a valve opening 71 adapted to be closed by the valve 68 which communicates with a passageway 72 in said piston, said passageway extending longitudinally of the piston. In proximity to the piston 63, cross passageways 73 are provided, which bring the passageway 72 into communication with the chamber 75 on the under side of the piston 63. The valve 68 is urged into closing position by means of a spring 76 which encircles the stem of the said valve and is seated against a collar 77 attached to the end of the same. The valve 68 is adapted to be unseated by means of a plunger 78 which is screwed into the bed 45 upon the under side thereof. This plunger extends through the piston 63 and into the passageway 72. A stuffing-box 79, attached to the piston 63, forms a fluid-tight connection between the said piston and plunger. When the piston 63 reaches its uppermost position, the end of the plunger 78 engages the valve stem 70 of the valve 68 and unseats the said valve, bringing the chamber 61 into communication with the chamber 75.

For the purpose of illustrating the application of my invention, a mold 81 is shown in Fig. 1.

This mold consists of a die block 82, having a cavity 83 in it in which is formed a cup-shaped member 84. A similar die-block 85 is formed with complementary projection 86 which, when inserted into the cavity 83, forms the molded product. The die block 82 rests upon a heater 87 which, in turn, rests upon parallel bars 88, underlying the upper surface of the bed 45. The die block 82 has bolts 89 extending through the same, which are screwed into the tapped holes 91 therein. The die block 85 is similarly attached to the platen 31. When the mold cavity is filled with plastic material and the platen and bed moved toward each other, the material in the mold cavity is compressed and heated to form the ultimate product.

A pipe 92, screwed into the bed 45 is connected with a passageway 93, which communicates with the chamber 74 of cylinder 43. A pipe 90, threaded into the cylinder head 41 is connected to a passageway 94 which communicates with the chamber 75 of cylinder 43. A pipe 95 threaded into the cylinder 36 at the locality of the bore 38 communicates with the chamber 82 of cylinder 36 through a passageway 96. The pipe 90 is connected to a reservoir 97 by means of another pipe 102 which pipe extends down into the said reservoir in close proximity to the bottom thereof. The reservoir 97 is mounted on the framework A. Issuing from the side of the reservoir are lugs 98 which are bolted to the flanges of the frame member 21 by means of bolts 99. A sight glass 101 is secured to the reservoir 97. It will be noted that the chamber 75 is at all times in communication with the reservoir 97. The reservoir 97 is filled partly with oil or whatever liquid is to be used in the operation of the press. This oil is maintained under pressure by directing compressed air into the said reservoir at the upper end thereof through a pipe 103 which is connected to the said reservoir and to a source of compressed air. A valve 104 in said pipe shuts off the air when the pressure in the reservoir 97 is sufficient.

The motor D and the pump E may be of standard construction. The motor D is provided with a base 105 which is attached to the top 14 of the tank C by means of bolts 106. This motor has a shaft 107 which is coupled by means of a coupling 108 with the shaft 109 of pump E. The pump E has a base 111 which is mounted on two transverse frame members 112 secured to two longitudinal frame members 113. The latter frame members rest upon and are attached to the top 14 of tank C. These frame members raise the pump E so that the shaft thereof is in alignment with shaft 107 of motor D. The inlet to the pump E is connected by means of a pipe 114 with the outlet pipe 17 of tank C, so that the liquid within the said tank is delivered to the pump and discharged therefrom through the discharge outlet of said pump. Connected to the discharge outlet of the pump E is a pipe 115 which is connected in the system as will be presently described in detail.

In Fig. 4 I have shown in diagrammatic form the piping connected to the various parts of my improved hydraulic press. For controlling the operation of the press a manually operable controlled valve 116 is employed which has a bore 117 extending throughout the length thereof and closed at its ends. Slidably mounted in the bore 117 is a piston assembly 110 having three pistons 118, 119 and 121 which are mounted on a single plunger 122. Plunger 122 extends out-

wardly through the device and has attached to it an operating lever 123 by means of which the piston assembly 110 may be reciprocated within the bore 117. Formed in the valve 116 are ports 124, 125, 126, 127, 128 and 129. The pipe 115 leading from the pump E has two branches 131 and 132 which are connected to the ports 127 and 128. The return pipe 18 leading the tank C is connected to two branch pipes 133 and 134 which, in turn, are connected to the ports 126 and 129. The port 125 is connected by means of a pipe 135 with a relief valve 136 which in turn is connected to the pipe 95. The other port 124 of the valve 116 is connected by means of a pipe 138 with a relief valve 139. This relief valve is connected to the pipe 92. Both the relief valves 136 and 139 are provided with by-pass pipes 141 and 142 which are connected to the return pipe 18. The two relief valves 136 and 139 are operated under considerable pressure and have connected to them control valves 143 and 145. The valve 145 has a pipe 146 connected to the cylinder of valve 139 and another pipe 147 connected to the return pipe 18. Likewise, the valve 143 has a pipe 148 connected to the cylinder of the valve 136 and a pipe 149 connected to the return pipe 18. By adjusting the control valves 143 and 145 the pressure within the valves 136 and 139 may be regulated. As previously brought out, the reservoir 97 is filled with liquid up to the level indicated at 151 and with a gas indicated at 152 above the liquid. For the purpose of the invention air under pressure may be used as the gas which is delivered into said reservoir at the top thereof through the pipe 103 previously referred to. The pipe 93 which is connected to the reservoir 97 extends down toward the bottom of said reservoir so that the pressure of the gas 152 will raise the liquid in said pipe and force it into the piston chamber 75.

The operation of the invention is as follows: Assume that the parts are arranged as shown in Fig. 4. The pump E delivers liquid under pressure to the valve 116, which liquid passes through the port 128 and port 125 into the pipe 135. The liquid then passes through the valve 136 and pipe 135 into the cylinder chamber 62. This urges the piston 52 upwardly and separates the platen 31 and bed 45. After the platen 31 reaches its ultimate position the valve 136 opens and the surplus liquid passes through pipe 141 into the return pipe 18 and back to tank C. At the same time pipes 92 and 138 are connected through ports 124 and 126 with pipe 133 and the return pipe 18 permitting cylinder chamber 74 to exhaust. In this position of the parts the mold 81 may be filled with plastic material.

Upon moving the lever 123 to the position shown in Fig. 5 the following action takes place: Ports 127 and 128 are connected to ports 126 and 129 so that the pump E is connected directly to the return pipe 18. The cylinder chambers 74 and 62 are also connected to the return pipe 18 due to the fact that the port 124 is in communication with port 126 and the port 125 is in communication with the port 128. These cylinder chambers are thus not under pressure. The gas 152 in reservoir 97 being under pressure forces the liquid through the pipe 90, as indicated in Fig. 5, and into the cylinder chamber 75. The liquid passes through the passageways 73 and 72 and past the valve 68 into the cylinder chamber 61. Cylinder chamber 62 being connected to the return pipe 18, as previously described, the

piston 52 lowers and the platen 31 is caused to move toward the bed 45 and to bring the two parts of the mold 81 together. If a pressure of 100 lbs. per square inch is maintained in the reservoir 97 sufficient movement of the platen is procured to bring the parts of the mold into almost closing position. Thus the platen moves quickly into a position in proximity to its final position.

Movement of the platen into final position is procured by moving the lever 123 to its position shown in Fig. 6. In Fig. 5 the piston 52 has been shown as partly lowered. When the lever 123 is moved to the position shown in Fig. 6 port 127 is connected with port 124 and port 126 is closed. This causes the pump E to force the liquid through pipe 115, pipe 138, through valve 139 and through pipe 92 into cylinder chamber 74. The pump E is designed to exert a pressure of from 500 to 1000 lbs. per square inch. This causes the piston 63 to descend. Inasmuch as piston 65 is connected to the piston 63, the same travel together. Upon initial movement of the piston 63 spring 76 closes valve 68 and the flow of fluid through the passageways 73 and 72 terminates. The forcing of piston 65 into the cylinder chamber 61 increases the pressure therein in proportion to the inverse ratio of the diameters of the pistons 65 and 63. If the ratios of these pistons are 5 to 1 a pressure of 4500 lbs. per square inch can be had in the cylinder chamber 61 which causes final movement of the platen 31 to close the mold 81. During movement of the piston 63 the cylinder chamber 62 is still connected to the return pipe 18 since ports 129 and 125 are in communication. The mold is then allowed to remain the necessary time in closed position to permit the heater 87 to cure the material within the mold. During movement of the piston 63 downwardly the liquid within cylinder chamber 75 is being compressed and forced back through pipe 90 into the reservoir 97. This establishes the original pressure in the said reservoir.

Upon lapse of required time for the curing of the molded product in mold 81 lever 123 is returned to its position shown in Fig. 4. This connects port 124 with port 126 thus connecting cylinder chamber 74 with the return pipe 18. At the same time port 128 is connected to port 125 so that the pump E delivers fluid under pressure to cylinder chamber 62. This causes the piston 52 to rise and the piston 63 aided by the pressure against the valve 68 forming a part of piston 65 and the pressure in cylinder chamber 75 occasioned by the pressure in reservoir 97 causes the piston 63 also to rise. When the piston 63 approaches its uppermost position the plunger 78 engages the valve stem 70 and again opens the valve 68. The parts are now arranged as shown in Fig. 4 with the platen and bed widely separated to permit of removing the finished molded product and to apply another charge preparatory to repetition of the cycle.

The advantages of my invention are manifest. The device operates with but a single rotary pump. This pump may be a gear pump which is relatively inexpensive. In a gear pump pressures from 500 to 1000 lbs. per square inch are easily attained. Thus with the proper power advantage of the auxiliary pump cylinder and high pressure cylinder, pressure up to 4500 lbs. per square inch can be procured where a pressure of 100 lbs. per square inch is maintained in the pressure reservoir. My improved hydraulic press operates extremely efficiently requiring but a mini-

mum amount of power to operate. The opening of the press and the initial closing of the press is accomplished very rapidly so that loss of time is eliminated. Only when the press is moved to final position is the speed of the movement reduced. The press may be used for molding plastic materials and also for heavy punch press work where great pressure and rigidity is required. With my improved press no valves are required to be manipulated while the pressure is at a maximum thus making it possible to use simple valves and simple operating mechanisms therefor.

Changes in the specific form of my invention, as herein disclosed, may be made within the scope of what is claimed without departing from the spirit of my invention.

Having described my invention, what I claim as new and desire to protect by Letters Patent is:

1. In an actuating mechanism for a press having a bed and a platen guided for relative movement, a means forming an expansible press chamber including a press, piston acting to procure relative movement between said bed and platen and a high pressure piston, a pump cylinder, a piston therein for operating said high pressure piston, a reservoir containing a liquid and a gas under pressure, means for connecting said pump cylinder to said reservoir to procure return movement of said high pressure piston, means for connecting said press chamber to said reservoir to procure relative movement between said bed and platen toward one another, means for subjecting said pump piston to a fluid under pressure to procure pumping action of the high pressure piston and further movement between said bed and platen, and means for procuring movement of the bed and platen away from each other.

2. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, means forming a valve-controlled passageway connecting said conduit and said press chamber and means for conducting fluid under pressure into the pump chamber to compress the fluids in said reservoir and to operate said high pressure piston.

3. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pump-

ing action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said press piston being movable independently of the high pressure piston during operative movement of said press piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, and means forming a valve-controlled passageway between said return chamber and press chamber for conducting liquid from said return chamber and into said press chamber.

4. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, said return chamber being at all times connected to said reservoir and means forming a valve-controlled passageway between said return chamber and press chamber for conducting liquid from said return chamber and into said press chamber.

5. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber, and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said press piston being movable independently of the high pressure piston during operative movement of said press piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, said high pressure piston having a passageway therein communicating with said press chamber and said return chamber, and conducting liquid from said return chamber to said press chamber, a valve in said passageway and means operated by said pump piston for opening said valve.

6. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being

operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, said high pressure piston having a longitudinally extending passageway therein communicating at one end with the return chamber and extending through the opposite end of the high pressure piston and communicating with the press chamber at such end, a valve seat formed on the high pressure piston at the last named end thereof and a valve engaging said seat and held in engagement therewith through the pressure in said press chamber.

7. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, said high pressure piston having a longitudinally extending passageway therein communicating at one end with the return chamber and extending through the opposite end of the high pressure piston and communicating with the press chamber at such end, a valve seat formed on the high pressure piston at the last named end thereof and a valve engaging said seat and held in engagement therewith through the pressure in said press chamber, and means for unseating said valve and operated by said pump piston.

8. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said press piston being movable independently of the high pressure piston during operative movement of said press piston, and means forming a valve controlled passageway between said return chamber and press chamber for conducting fluid from said return chamber and into said press chamber.

9. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is di-

rected into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said high pressure piston having a passageway therein communicating with said press chamber and said return chamber, during operative movement of said press piston, and conducting liquid from said return chamber to said press chamber, a valve in said passageway and means operated by said pump piston for opening said valve.

10. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said high pressure piston having a longitudinally extending passageway therein communicating at one end with the return chamber and extending through the opposite end of the high pressure piston and communicating with the press chamber at such end, a valve seat formed on the high pressure piston at the last named end thereof and a valve engaging said seat and held in engagement therewith through the pressure in said press chamber.

11. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said high pressure piston having a longitudinally extending passageway therein communicating at one end with the return chamber and extending through the opposite end of the high pressure piston and communicating with the press chamber at such end, a valve seat formed on the high pressure piston at the last named end thereof and a valve engaging said seat and held in engagement therewith through the pressure in said press chamber, and means for unseating said valve and operated by said pump piston.

12. A control device for a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid

under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said control device including a reservoir containing a liquid and gas under pressure, a conduit connected to said return chamber and communicating with the liquid in said reservoir, means forming a valve-controlled passageway between said return chamber and said press chamber for conducting fluid under pressure from the return chamber to said press chamber during operative movement of the press piston and means for conducting fluid under pressure to said pump chamber.

13. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber, and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, a reservoir containing a liquid and gas under pressure, a conduit communicating with the liquid in said reservoir and connected to said return chamber, said high pressure piston having a longitudinal passageway communicating at one end with said press chamber and a transverse passageway disposed within the confines of the return chamber and communicating with said longitudinal passageway and said return chamber and conducting liquid from said return chamber to said press chamber and a valve in said passageway.

14. In a hydraulic press including a bed and a platen movable relative to one another, means forming an expansible press chamber and including a high pressure piston and a press piston, said press piston when fluid under pressure is directed into the press chamber causing relative movement of the bed and platen toward one another, means forming an expansible pump chamber and an expansible return chamber, said means including a pump piston, said high pressure piston being operated by said pump piston, said pump piston when a fluid under pressure is directed into said pump chamber causing pumping action of said high pressure piston and when directed into the return chamber causing return movement of the high pressure piston, said high pressure piston having a passageway therein communicating with said press chamber and said return chamber during operative movement of said press piston, and conducting liquid from said return chamber to said press chamber, a valve in said passageway and means movable with said pump piston and engaging a part fixed relative to the means forming the pump chamber, said means and part serving to open said valve.

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