Nov. 24, 1936. L. S. HUBBERT 2,061,658

HYDRAULIC COMPRESS

Filed July 17, 1933 7 Sheets-Sheet 1

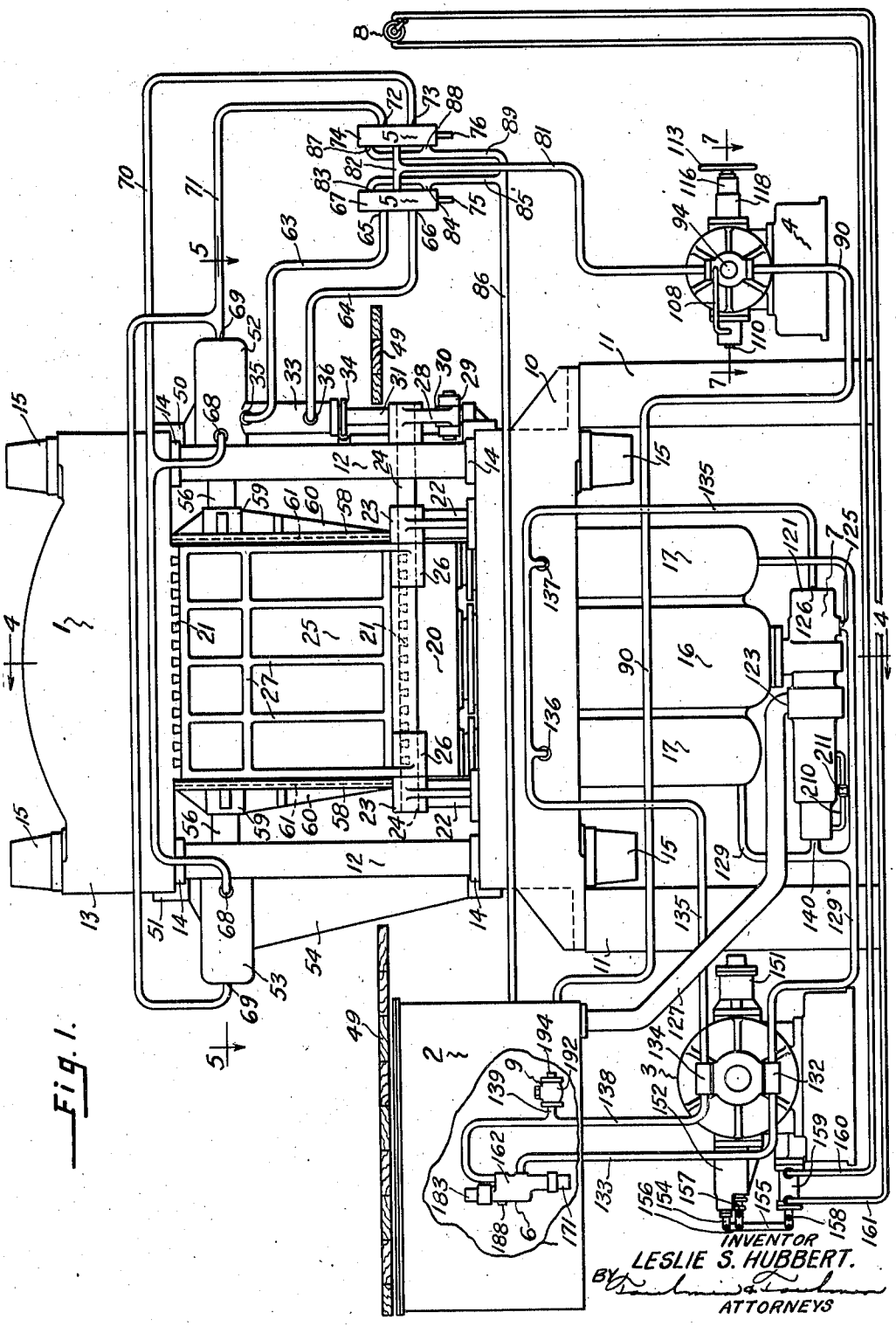


Fig. 1.

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HYDRAULIC COMPRESS

Filed July 17, 1933 7 Sheets-Sheet 2

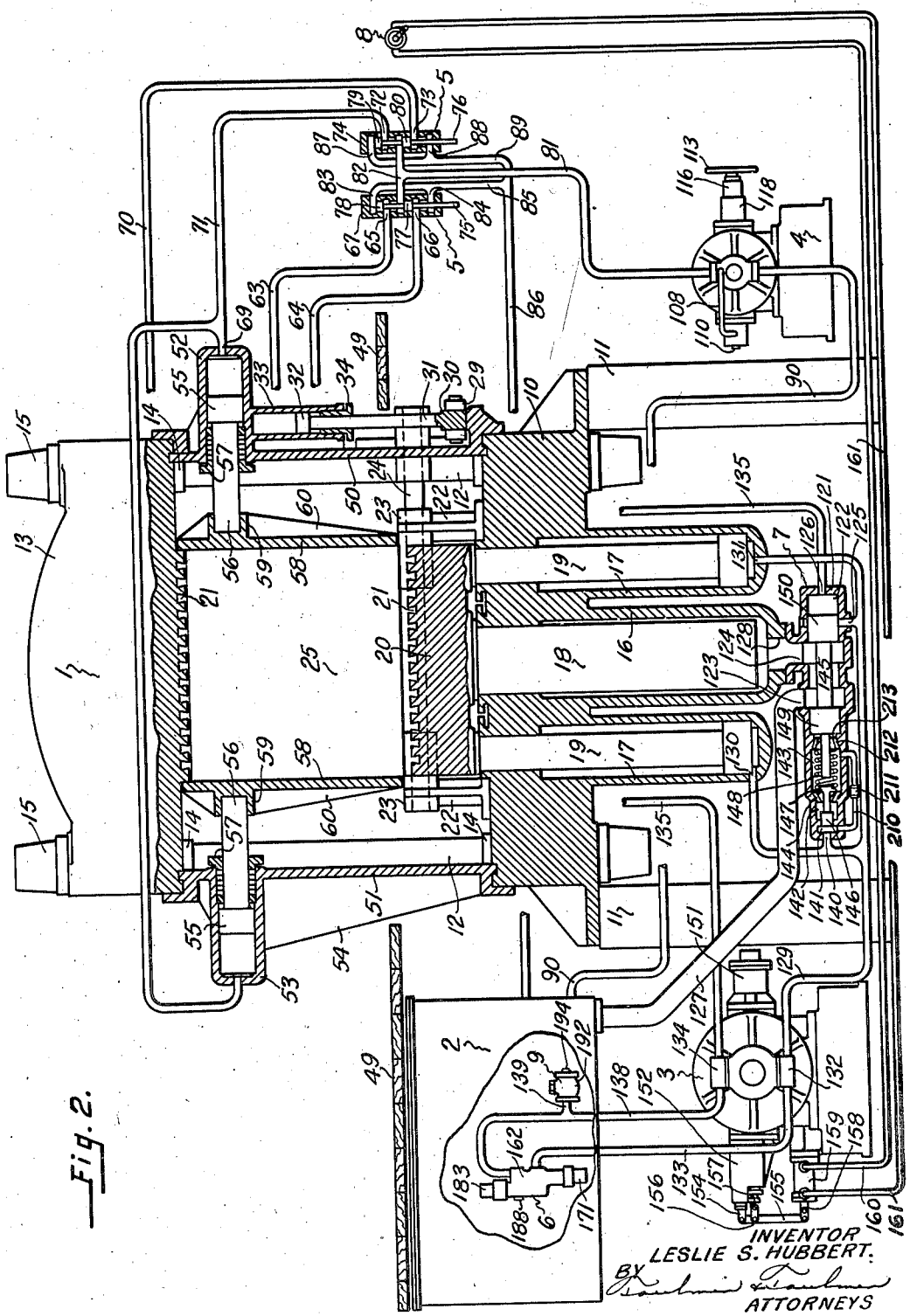


Fig. 2.

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HYDRAULIC COMPRESS

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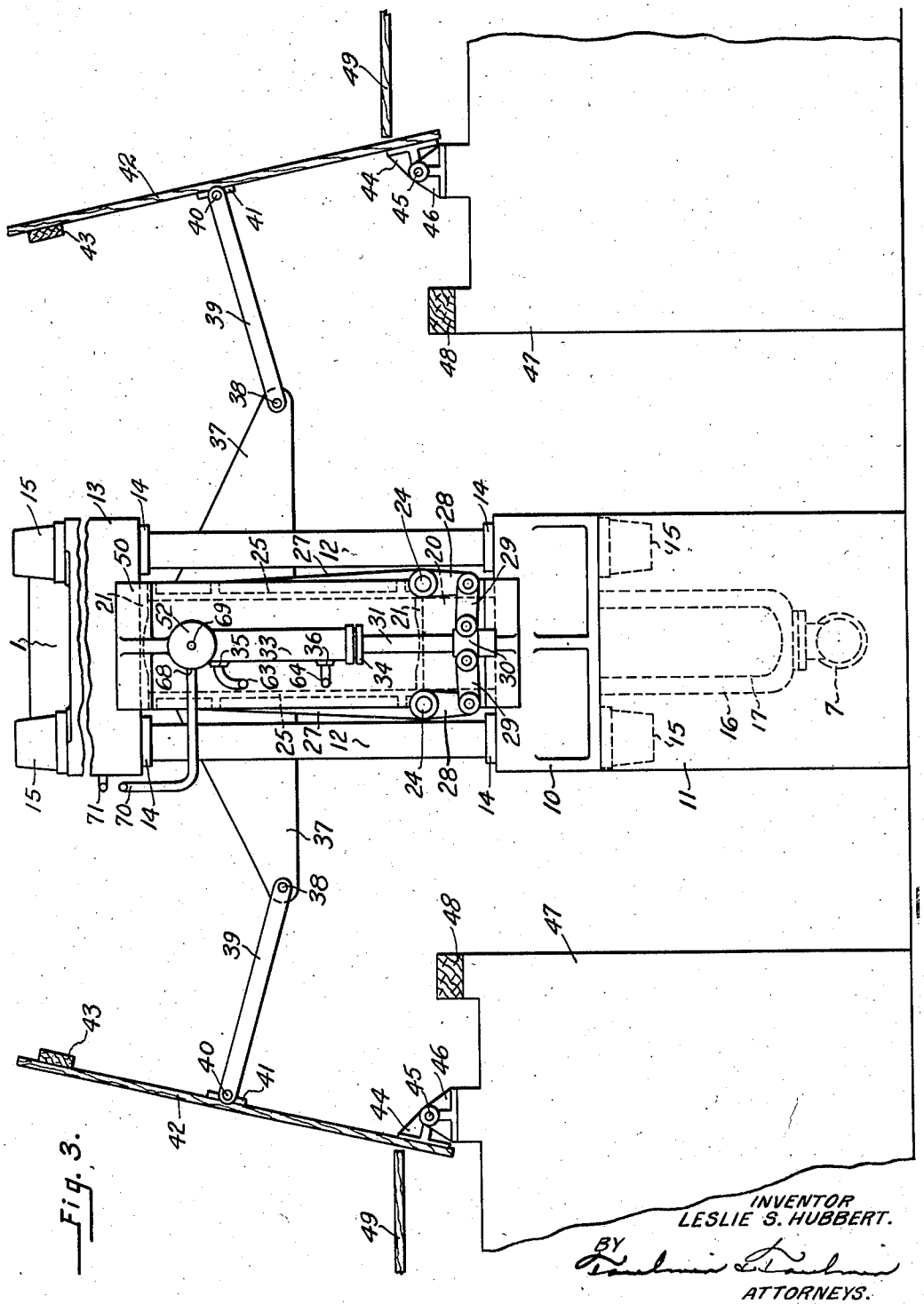


Fig. 3.

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HYDRAULIC COMPRESS

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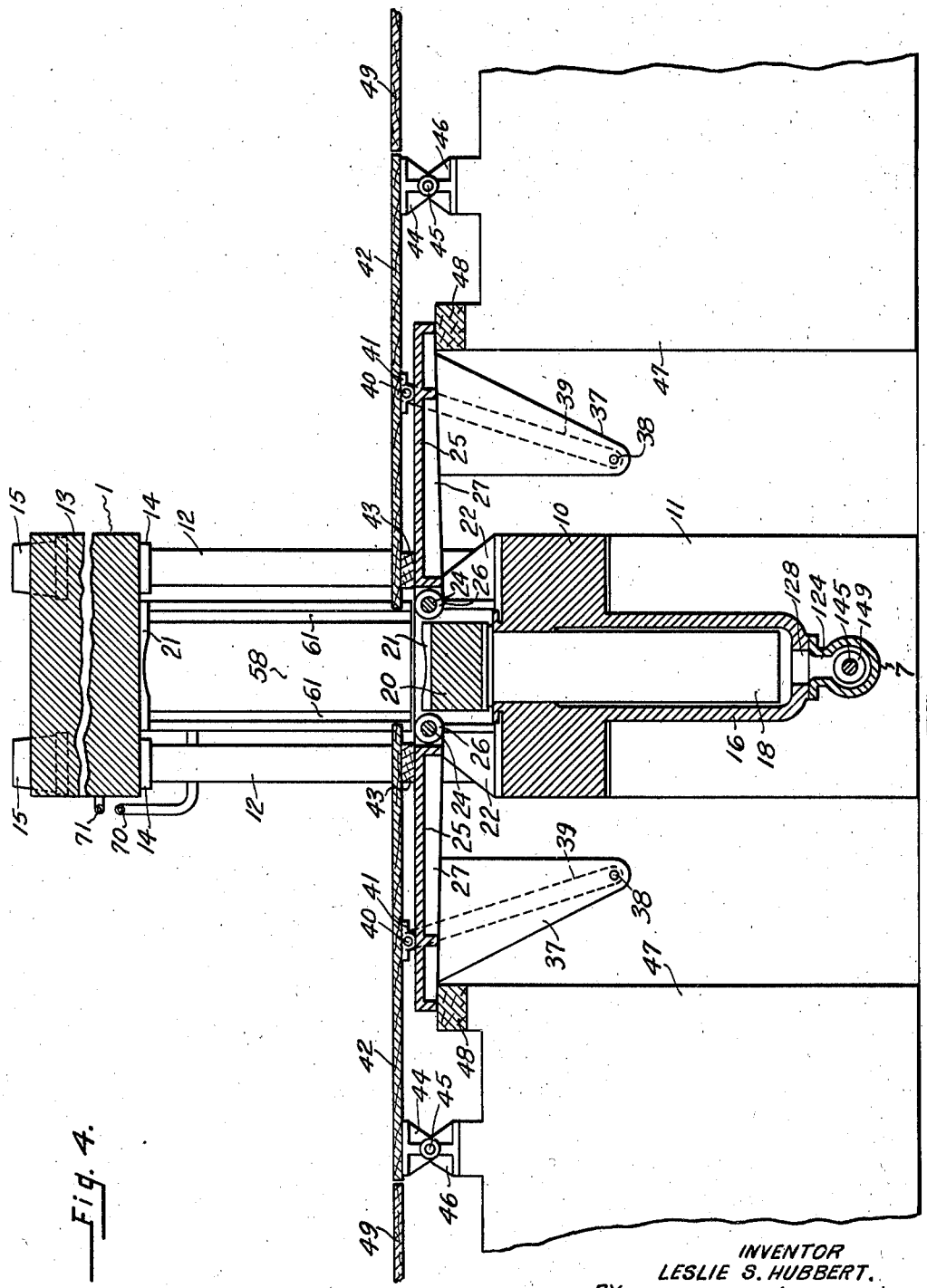


Fig. 4.

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HYDRAULIC COMPRESS

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Fig. 5.

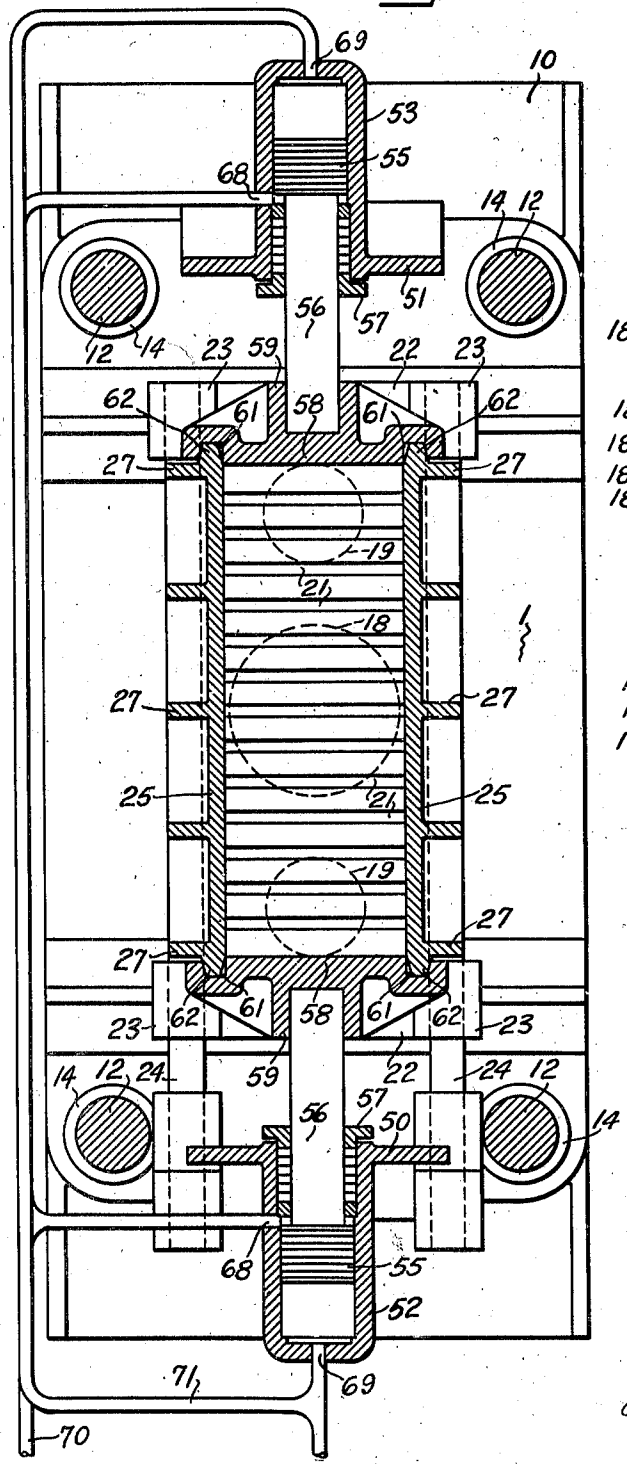
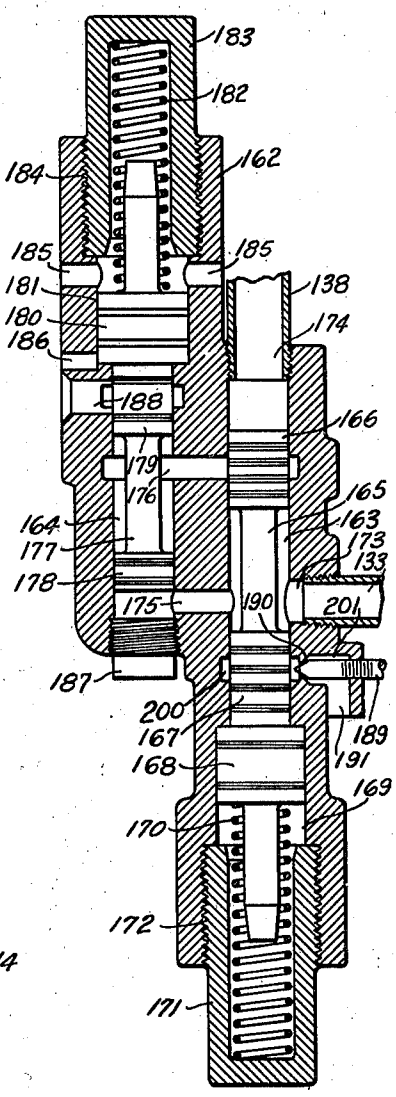


Fig. 6.



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HYDRAULIC COMPRESS

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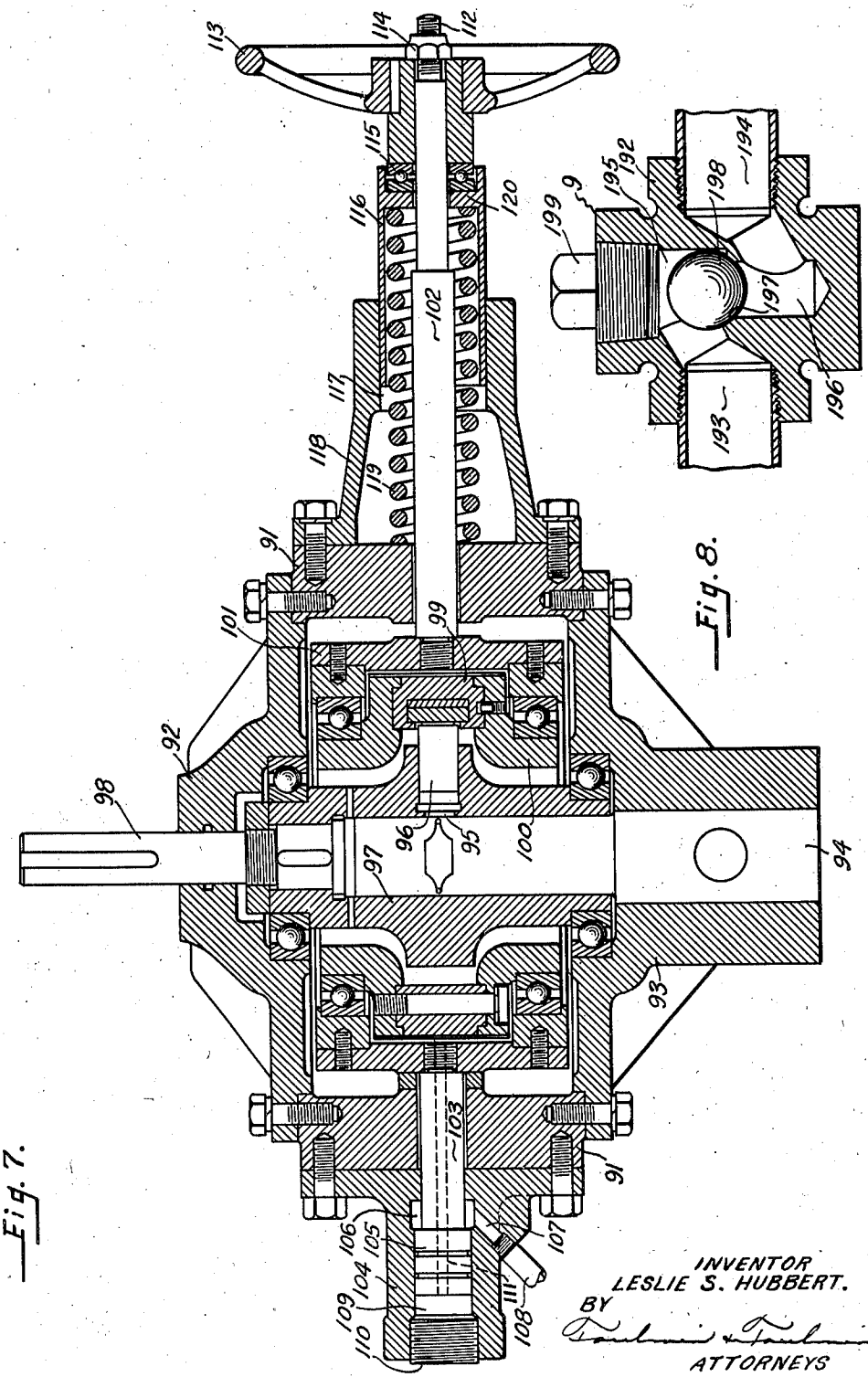


Fig. 8.

Fig. 7.

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HYDRAULIC COMPRESS

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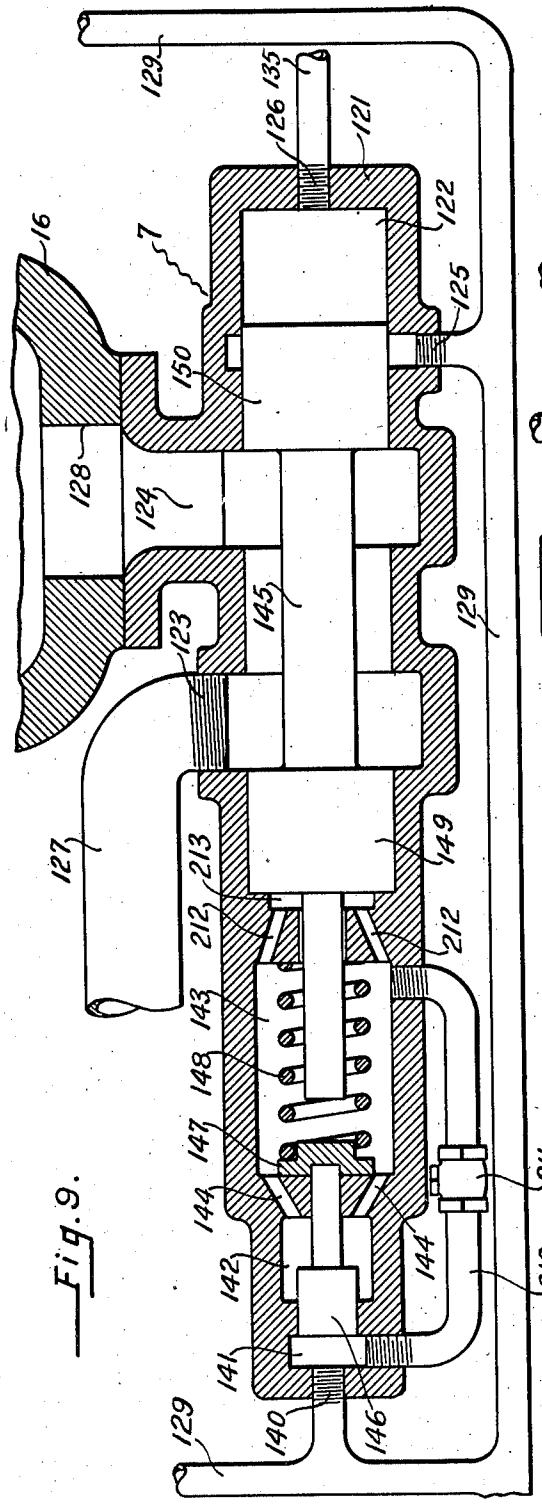


Fig. 9.

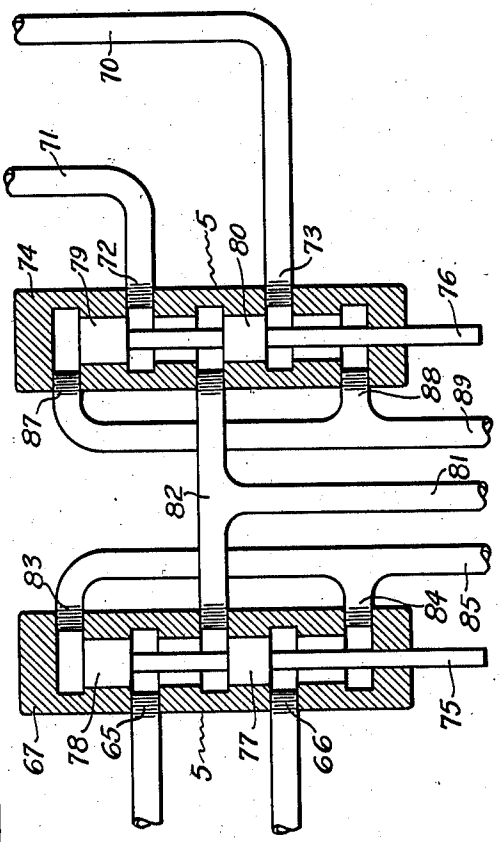


Fig. 10.

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Patented Nov. 24, 1936

2,061,658

UNITED STATES PATENT OFFICE

2,061,658

HYDRAULIC COMPRESS

Leslie S. Hubbert, Edison, Ohio, assignor, by mesne assignments, to The Hydraulic Press Corporation, Inc., Wilmington, Del., a corporation of Delaware

Application July 17, 1933, Serial No. 680,711

7 Claims. (Cl. 100—19)

This invention relates to compresses and especially to hydraulic compresses wherein the cotton or other compressed material is subjected to the application of hydraulic compressing force.

An object of my invention is to provide a hydraulic compress wherein the cotton or other material to be compressed is confined on its sides and ends by movable doors, and compressed by pressure applied from below and exerted against a stationary head above the cotton; and hydraulic pressure is applied to the ends.

Another object is to provide a hydraulic compress actuated by hydraulic motors consisting of hydraulic cylinders, wherein the initial compressing force is provided by auxiliary hydraulic cylinders and the final compressing force by these aided by a main cylinder whose action is delayed and automatically introduced when the hydraulic pressure, built up against the resistance of the cotton, reaches a predetermined value.

Another object is to provide a hydraulic compress wherein the various hydraulic motors or cylinders are operated by a variable delivery reversible pump.

Another object is to provide a hydraulic compress wherein the press is provided with false doors or movable platforms cooperating with the doors of the press to aid in the safety and convenience of loading and unloading the cotton in the press.

Another object is to provide a hydraulic compress having hydraulically-operated end doors and side doors which mutually interlock in their closed positions.

Another object is to provide a surge valve for a hydraulic compress wherein the valve member is actuated automatically by pressure in the hydraulic circuit, and caused to change its setting when a predetermined pressure is reached.

Another object is to provide a relief and by-pass valve for a hydraulic compress which at the instant of reversal will momentarily permit a controlled release of pressure from the main hydraulic motor or cylinder and by-pass the output of the pump until this release has taken place.

Another object is to provide a hydraulic compress wherein the doors are actuated by an independent hydraulic pump which is automatically returned to its neutral discharge position when the doors of the compress reach their closed position.

Another object is to provide a method of compressing yieldable materials wherein a low pressure is initially applied and a high pressure subsequently applied when the initial pressure rises to a predetermined value.

In the drawings:

Figure 1 is a front elevation of the hydraulic compress of my invention, showing the associated hydraulic circuit and the various units thereof.

Figure 2 is a front elevation, partly in central vertical section, of the apparatus in Figure 1.

Figure 3 is a side elevation of the hydraulic compress shown in Figure 1.

Figure 4 is a central vertical section along the line 4—4 of Figure 1, with the side doors and false doors in a lowered position.

Figure 5 is a horizontal cross section through the hydraulic compress of Figure 1 along the line 5—5 thereof.

Figure 6 is an enlarged central vertical section through the relief and by-pass valve shown in Figure 1.

Figure 7 is an enlarged horizontal cross section through the door-actuating pump for the hydraulic compress, along the line 7—7 of Figure 1, showing the device for returning the pump to its neutral position when the doors reach their closed positions.

Figure 8 is an enlarged cross-sectional view of the suction check valve shown in Figure 1.

Figure 9 is an enlarged central vertical section through the surge valve shown in Figures 1 and 2.

Figure 10 is an enlarged central vertical section through the door-controlling valve unit shown in Figures 1 and 2.

In general (Figure 1) my hydraulic compressing apparatus consists of the hydraulic compress itself, generally designated 1; a fluid tank, generally designated 2; a hydraulic pump for actuating the pressing cylinders, generally designated 3; another hydraulic pump for operating the doors of the compress, generally designated 4; a door controlling valve unit, generally designated 5; a relief and by-pass valve, generally designated 6; a surge valve adjacent to the main cylinder of the press, generally designated 7; a servo-motor control valve, generally designated 8 for regulating the servo-motor which controls the discharge position of the pump 3; and a suction check valve, generally designated 9.

Hydraulic compress construction

Referring to the drawings in detail, Figure 1 shows the hydraulic compress 1 of my invention associated with its auxiliary units and controls. The hydraulic compress itself comprises a main base 10 supported on suitable foundation mem-

bers 11 and having side pillars 12 rising therefrom and supporting the compress head 13; the pillars 12 bear flanged portions 14 which serve to provide a bearing surface for the pillars 12 against the main base 10 and the compress head 13 respectively. The compress head 13 is held in place against the flanges 14 on the pillars 12, and these in turn held against the main base 1, by suitable retaining members 15.

Beneath the main base 10 and associated therewith are the main hydraulic motor consisting of the main pressing cylinder 16 and the auxiliary hydraulic motors consisting of the auxiliary pressing cylinders 17 which contain the main ram 18 and auxiliary rams 19 respectively, these being attached at their upper ends to the compress platen 20 which is moved up and down under the influence of the previously mentioned rams. The platen 20 and the head 13 are provided with slots 21 in their opposing surfaces, these slots being adapted to receive binding members whereby the compressed materials may be baled and suitably held in their compressed positions.

The main base 10 of the compress carries brackets 22 which have bearing portions 23 suitably bored to pivotally receive shafts 24 passing therethrough. The shafts 24 carry the side doors 25 of the compress, each of these being provided with yoked portions 26 adapted to engage the shaft 24. The side doors 25 are provided with reinforcing webs 27. The shafts 24 terminate in arms 28 (Figure 3) rigidly mounted thereon and pivotally connected at their free ends to the links 29 which in turn are connected at their opposite ends to the cross head 30.

The cross head 30 is mounted upon the piston rod 31 having a piston head 32 (Figure 2) which is reciprocably mounted in the cylinder 33, this being closed at its open end by the closure member 34. The cylinder 33 is provided with ports 35 and 36 (Figure 3) for the passage of pressure fluid, whereby the piston head 32 is caused to move up or down, carrying with it the piston rod 31 and the cross head 30, thus raising or lowering the side doors 25 through the intermediate action of the links 29 and the arms 28 upon the door shafts 24.

The side doors 25 likewise carry arms 37 rigidly associated therewith and having at their outer ends a pivotal connection by pins 38 (Figure 3) to links 39 whose opposite ends are pivotally attached by pins 40 to the pivot supports 41 mounted on the false doors 42 associated with the hydraulic compress. The upper portions of the false doors 42 contain reinforcement members 43, whereas the lower portions carry arms 44 adapted to receive the pivot pins 45 through which they are pivotally connected to the brackets 46 mounted upon the door foundations 47 (Figure 3). The door foundation members 7 likewise carry door stops 48 which are arranged at such height that they serve as rests for the side doors 25 in their lowered positions. It will also be seen that when the side doors 25 are lowered by the action of the previously described mechanism, their arms 37 and associated links 39 will pull the false doors 42 into superposition on the side doors 25 (Figure 4). In this position the reinforcement members 43 of the false doors 42 serve as rests for the latter upon the side doors 25. Cooperating with the false doors 42 are fixed platforms 49 which are arranged on the same level as the false doors 42 when the latter are in their lowered positions.

The ends of the compress carry end plates 50 and 51 (Figure 2) which extend between the main base 10 and the compress head 13, and which serve as supports for the hydraulic motors consisting of the hydraulic cylinders 33, 52 and 53 which actuate the doors of the press. The cylinder 33 for actuating the side doors 25 is attached to the end plate 50. Also attached to the end plate 50 is a horizontal hydraulic cylinder 52, while immediately opposite it is a companion horizontal hydraulic cylinder 53 supported by the end plate 51 and reinforced therewith by a supporting arm 54 (Figure 1).

The horizontal hydraulic cylinders 52 and 53 (Figure 2) contain piston heads 55 attached to piston rods 56 passing through closure members 57 in the open ends of the hydraulic cylinders 52 and 53. Attached to the opposite ends of the piston rods 56 are the end doors 58 (Figure 2), the connection being made in the socket portions 59 of the end doors 58.

The end doors 58 carry reinforcing webs 60 and also are provided with recessed portions 61 (Figure 5) adapted to receive the edge projections 62 on the side doors 25. When the side doors 25 have been raised to their vertical positions, the end doors 58 are moved horizontally until their recessed portions 61 engage the edge projections 62 of the side doors 25 effectively interlocking the two sets of doors.

Hydraulic door operating mechanism

The hydraulic cylinder 33 whose piston head 32 and piston rod 31 raise and lower the side doors 25, and the hydraulic cylinders 52 and 53, whose piston heads 55 and the piston rods 56 bring the end doors into their closed positions have already been described. The hydraulic cylinder 33 has ports 35 and 36 which communicate with pipe lines 63 and 64 respectively (Figure 1), leading to upper and lower ports 65 and 66 in the side door valve cylinder 67 of the door regulating valve 5.

Similarly, the end door operating cylinders 52 and 53 (Figure 1) have ports 68 and 69 communicating with pipe lines 70 and 71 respectively, leading to lower and upper ports 73 and 72 (Figure 2) of the end door operating valve cylinder 74 in the door operating valve unit 5. The valve cylinders 67 and 74 contain valve stems 75 and 76 respectively. The stem 75 is provided with enlarged heads 77 and 78, whereas the stem 76 is provided with similar enlarged heads 79 and 80. These heads are spaced apart from one another by the same distance that separates the ports 65 and 66, also the ports 72 and 73 respectively. Communicating with the central portion of the valve cylinders 67 and 74 is the pressure pipe line 81 having the cross pipe 82. Connecting the upper and lower ports 83 and 84 of the valve cylinder 67 is a branch pipe 85 joined to the discharge pipe 86. Connecting the upper and lower ports 87 and 88 of the valve cylinder 74 is a branch pipe 89 also joining the discharge pipe 86. The discharge pipe 86 leads back to the fluid tank 2, whereas the pressure pipe 81 leads to the door-operating pump 4, from which the suction line 90 leads back to the fluid tank 2.

The door-operating pump 4 (Figure 7) is a variable delivery rotary pump of the radial cylinder type, the general details of which form no part of this invention. The pump consists of a casing 91 closed by end plates 92 and 93: the latter holds a fixed hollow pintle 94. The pintle 94 serves for the introduction of fluid to a plurality of radial cylinders 95 arranged with reciprocable pistons 96 in a primary rotor or cylinder barrel 97 which rotates freely around the pintle 94. The cylinder

barrel 97 is connected to a drive shaft 98 passing through the end plate 92 and connected to a suitable source of power supply. The pistons 96 are reciprocably mounted in guide blocks 99 which in turn are secured to a secondary rotor 100. The secondary rotor 100 is rotatably mounted within the secondary rotor shifting ring 101 and the latter connected to a shifting rod 102, whereby the shifting ring 101 may be moved laterally relative to the axis of the pintle 94. On the opposite side of the shifting ring 101 from the attachment of the shifting rod 102 is a piston rod 103 which is reciprocably mounted in a cylinder 104 attached to the pump casing 91. The piston rod 103 carries a piston head 105 reciprocably mounted within the cylinder 104 and having its end portion in a chamber 106 with an outlet port 107. The outlet port 107 is connected by a branch pipe 108 leading to the pressure pipe line 81. The opposite end of the piston 105 lies within the chamber 109 closed by the threaded plug 110. The chamber 109 communicates with the interior of the pump casing 91 by way of the drilled passage 111 through the piston 105 and the piston rod 103.

The secondary rotor shifting rod 102 of the pump 4 at its outer end bears a threaded portion 112 upon which operates a hand wheel 113 through the threaded nut 114 associated therewith. The hand wheel 113 bears against a thrust bearing 115, engaging the opposite side of which is a sleeve 116 reciprocably mounted in the bore 117 of the supporting portion 118 mounted on the pump casing 91. A compression coil spring 119 rests at one end against the pump casing 91 and at the opposite end against the end plate 120 of the sleeve 116, urging the latter outward from the casing 91. The force with which this urging will take place is adjusted by turning the hand wheel 113, which in turn moves the sleeve 116 in or out and accordingly compresses or allows expansion of the spring 119.

The primary and secondary rotors 97 and 100 are mounted upon suitable anti-friction bearings.

Surge valve construction

The surge valve 7 is attached to the lower end of the main pressing cylinder 16 (Figures 1 and 9) and consists of a hollow casing 121 within which is a bored chamber 122. The bored chamber 122 is provided with four ports 123, 124, 125 and 126, the casing 121 being provided with annular enlargements where the first three of these ports enter it. The port 123 communicates with the tank 2 through the pipe 127. The port 124 opens into the main pressing cylinder 16 through the short passageway 128. The port 125 is connected by the pipe 129 to the head ports 130 and 131 of the auxiliary pressing cylinders 17, all of which are joined by the same pipe 129 to the pressure outlet 132 of the main pressing pump 3. The line 133 continues from the line 129 beyond the outlet 132 and leads to the main cylinder relief and by-pass valve 6. The other pressure outlet 134 of the main pressing pump 3 communicates by the pipe line 135 with the ports 136 and 137 (Figure 1) at the upper ends of the auxiliary pressing cylinders 17. Since the main pressing pump 3 is of a reversible type, either of its outlets 132 and 134 may serve as a pressure supply source while the other acts to receive the fluid returned from the cylinders. Beyond the outlet 134 of the main pressing pump 3, the line 135 continues as the line 138 and proceeds also to the main cylinder relief and by-pass valve 6, a short branch 139 leading also to the suction check valve 9.

The pipe line 129 also communicates through the port 140 with the end chamber 141 (Figure 9). Adjacent to this is a second chamber 142, beyond which is a third chamber 143 communicating with the second chamber 142 through the passages 144 and with the end chamber 141 through the branch pipe 210 containing the one-way check valve 211. The latter is of identical construction with the check valve 6 (Figure 8). The chamber 143 is provided with ports 212 leading to the chamber 213 with its piston head 149. Reciprocably mounted between the chambers 141 and 142 is a piston 146 bearing a collar 147 against which presses a compression coil spring 148, whose opposite end rests against the partition between the chambers 143 and 213. Likewise reciprocably mounted within the casing 121 is a piston rod 145, one end of which serves as a guide rod for the coil spring 148. The mid-portion and the opposite end of the piston rod 145 contain a pair of enlarged heads 149 and 150 spaced apart from one another and movable integrally with the piston rod 145 by the action of fluid pressure thereon within the chambers 122 or 213 of the surge valve casing 121. The check valve 211 is so arranged as to allow fluid to pass freely from the chamber 143 to the chamber 141, but not in the reverse direction. The action of the piston 146 is resisted in one direction by the force of the coil spring 148 pressing against the collar 147 on the piston rod 146.

Main pressing pump construction

The details of the main pressing pump 3 (Figures 1 and 2) form no part of this invention and are already known to the art. The main pressing pump 3 is a reversible variable delivery pump of any suitable type. The assembly shown is controlled by means of a servo-motor cylinder 151 mounted on one side of the casing of the main pressing pump 3, on the opposite side of which is the servo-motor valve assembly 152 having a reciprocable valve member therein communicating with the valve rod 154 which in turn is pivotally attached to a lever 155 whose fulcrum 156 is movable under the influence of a piston attached to the piston rod 157, the latter being reciprocable in a second chamber within the casing of the servo-motor valve assembly 152 under the influence of pressure reaching it from the pipe line 133. The opposite end of the lever 155 is pivotally connected to a piston rod 158 which enters and is reciprocably mounted within the pneumatic cylinder 159. Within the latter the piston rod 158 is provided with a head which is moved in either direction by compressed air reaching it through the air pipes 160 and 161, these being connected to a source of compressed air (not shown) and likewise to a servo-motor control valve 8.

Adjustment of the servo-motor control valve 8 causes the piston rod 158 to move in or out, moving the lever 155 and accordingly the valve rod 154, thus causing the shifting ring of the main pressing pump 3 to be moved and thus varying the delivery of the pump. An excessive pressure arising in the pipe line 133 acts on the piston of the piston rod 157 and moves it outward, causing the fulcrum 156 likewise to move outward, and hence tending to return the shifting ring of the main pressing pump 3 to its neutral or zero-delivery position.

Construction of main cylinder relief and by-pass valve

The main cylinder relief and by-pass valve 6 (Figure 6) is suspended in the fluid inside the fluid tank 2, and consists of a casing 162 which contains two bored chambers 163 and 164. The lower part of the bored chamber 163 contains an annular enlargement forming a chamber 200 which opens directly into the tank 2 through the passages 201 and 191. These are adjustably choked by the needle valve rod 189 threaded through the casing 162 into the passage 201 where it engages the conical seat 190. The needle valve rod 189 is extended through the walls of the fluid tank 2 so as to be adjusted from the outside thereof.

The bored chamber 163 also contains a piston rod 165 having attached thereto the spaced heads 166 and 167, the latter of which bears a further enlarged head 168 reciprocable within the bored chamber 169 beyond the bored chamber 163. The lower end of the piston rod 165 is surrounded by a compression coil spring 170 resting against the piston head 168. The opposite end of the spring 170 rests against the end wall of a tubular cap 171 which is adjustably movable in or out of the casing 162 by the threaded connection 172 therebetween. By turning the cap 171, the compression force of the spring exerted upon the head 168 may be increased or decreased as desired.

The bore 163 is provided with a port 173 from which the pipe 133 runs back to the outlet 132 of the main pressing pump 3, and beyond it by the pipe line 129 to the surge valve and lower ends of the auxiliary pressing cylinders 17. Beyond the piston head 166 the bore 163 is provided with an outlet port 174 from which runs the pipe 138 back to the outlet 134 of the main pressing pump 3, and beyond it by the pull-back line 135 leading to the upper ends of the auxiliary pressing cylinders 17. From the lower part of the bore 163 to the lower end of the bore 164 runs the transverse passage 175, whereas from its upper end runs a similar passage 176, these two passages being spaced apart from one another by a distance slightly less than the spacing of the heads 166 and 167 on the piston rod 165.

Reciprocably mounted in the bore 164 is a piston rod 177 having a lower head 178 and an upper head 179 spaced therefrom, the latter having a further enlarged head 180 which is reciprocable within the enlarged extension bore 181 above the bore 164. The piston rod 177 at its upper end is surrounded by the compression coil spring 182 resting against the piston head 180. The opposite end of the spring 182 rests against the inner end wall of the adjusting cap 183 which engages the casing 162 in the threaded connection 184 therebetween. By turning the adjusting cap 183, the tension on the coil spring 182 may be increased or decreased, and the pressure exerted on the piston head 180 accordingly varied as desired. The upper end of the bore 181 is provided with outlet ports 185 communicating directly with the fluid in the tank 2, and thus allowing the free passage of fluid therethrough. The lower part of the bore 181 is provided with a port 186 for the same purpose as the ports 185.

The bored chamber 164 is provided at its lower end with a closure plug 187, and at its upper end with an outlet passage 188 which communicates directly with the fluid in the tank 2 in which the valve 6 is suspended.

The suction check valves 9 and 211 (Figures 1, 2 and 8) are of the ball type, providing unidirectional flow of fluid. They consist of a casing 192 having oppositely disposed ports 193 and 194 and an upper chamber 195 and a lower chamber 196. Between the upper chamber 195 and the lower chamber 196, the casing 192 is provided with a concave annular spherical portion 197, against which fits a ball 198. Thus it will be seen that the fluid can pass upward from the port 194 through the chamber 196 into the chamber 195 and through the port 193 by merely pushing the ball upward. The chamber 195 is closed by a screw plug 199 which gives access to the ball 198. Back pressure developing in the pipe 193, however, will force the ball 198 downward against its seat 197 and prevent the escape of any fluid from the chamber 195 to the chamber 196.

Operation of the hydraulic cotton press

It will be assumed that the press is at rest and that the end doors are pulled apart by causing their piston rods 56 to move away from one another, and also that the side doors 25 are in their horizontal positions with the false doors 42 superposed upon them, as shown in Figure 4. This is the loading position of the press. The platen 20 of the press (Figure 4) is, of course, in its lowest position.

The cotton or other yieldable material to be compressed is usually brought to the press in the form of bundles or low density bales. The purpose of further compression is to greatly increase the density of these bales and thus cause them to occupy a smaller amount of space in the ship or car used for their further transportation. The loose bale is moved across the platform 49 (Figure 4) and the false door 42 on to the upper surface of the press platen 20. Suitable binding members are arranged in the slots 21.

The door-operating pump 4 is now placed in operation by starting the electric motor or other power source which actuates it. The valve rod 75 of the door controlling valve unit 5 is then pushed upward into the position shown in Figure 2, thereby allowing pressure fluid to proceed from the door-operating pump 4 through the line 81 and the branch line 82 into the middle portion of the valve casing 67, thence outward through the port 65 and along the pipe 63 into the upper part of the side door cylinder 33. The pressure fluid thus entering the latter chamber causes the piston 32 and the cross head 30 (Figure 3) to move downward, causing the links 29 to act upon the arms 28 and turn the shafts 24, thus raising the side doors 25 from their horizontal to their vertical positions. At the same time the arms 37 on the side doors 25 move upward and raise the false doors 42 through the intermediate action of the links 39 therebetween.

The valve rod 76 of the door-operating valve unit 5 is now raised to the position shown in Figure 2, so that pressure fluid flows from the door-operating pump 4 through the pipe 81 and the branch pipe 82 into the middle chamber of the valve casing 74, thence through the port 72 into the pipe 71 and thence into the outer chambers of the end door operating cylinders 52 and 53. The pressure fluid in these chambers then acts against the pistons 55, causing them to move inward and thus moving the end doors 58 toward one another (Figure 2) until their slotted portions 61 engage the ridged portions 62 (Figure 5) on the side doors 25, thus locking the end doors 58 and

the side doors 25 firmly together in their closed positions.

Meanwhile the fluid displaced from the opposite ends of the door-operating cylinders 33, 52 and 53 returns to the fluid tank 2 by way of the pipes 64 and 70 respectively, the door-operating valve unit 5, the branch pipes 85 and 89, and the return pipe 86. When the end doors 58 and the side doors 25 become thus interlocked, they can move no farther, and pressure accordingly piles up in the door-operating cylinders 33, 52 and 53. This pressure backs up in the pipe lines 63 and 71, thence back through the pipe 81 and the branch pipe 108 into the chamber 106 (Figure 7) of the cylinder 104 by way of the inlet port 107. The cylinder 104, it will be recalled, is mounted on one side of the door-operating pump 4. The piston 105 is then caused to move to the left under the influence of the pressure in the chamber 106, overcoming the force of the compression spring 119, and pulling the secondary rotor 100 of the door-operating pump 4 toward its neutral or zero-discharge position. Thus the door-operating pump 4 tends to hold the pressure in the door-operating cylinders 33, 52 and 53, but not to increase this pressure beyond the amount determined by the force of the compression spring 119 as adjusted by the hand wheel 113. Any fluid which chances to be in the chamber 109 in front of the piston head 105 escapes through the drilled passage 111 into the interior of the pump casing 91.

The servo-motor control valve 8 is now adjusted to cause the main pressing pump 3 to deliver pressure fluid into the pressing pipe line 129. At this stage the surge valve members are assumed to be in the position shown in Figures 2 and 9, with the piston heads 146, 149 and 150 moved to their extreme lefthand positions. The pressure fluid now flows by way of the pressing line 129 through the ports 130 and 131 of the auxiliary pressing cylinders 17, causing the pistons 19 thereof to move upward, compressing the cotton imprisoned between the end doors 58 and the side doors 25 against the platen 20 and the press head 13. Meanwhile fluid is sucked freely from the tank 2 through the pipe 127 into the middle portion of the bored chamber 122 and thence upward through the passage 124 into the main pressing cylinder 16.

The platen 20 thus continues to move upward, and the resistance it encounters becomes greater and greater as the cotton is further compressed, causing the pressure of the pressure fluid in the various chambers served by the pressing line 129 to increase as a consequence. When this pressure reaches a predetermined value in the chamber 141 of the surge valve 7 (Figure 2), it overcomes the resistance of the coil spring 148, thus causing the piston 146 to move inward, allowing the pressure fluid to flow through the chamber 142, the ports 144, the chamber 143 and the ports 212 into the chamber 213 behind the piston head 149, shifting the piston heads 149 and 150 to the right of their positions shown in Figures 2 and 9.

In their thus displaced positions, the piston heads 149 and 150 respectively cover up the entrance port 123 from the tank pipe line 127 and uncover the inlet port 125 from the pressing line 129. Pressure fluid is enabled to flow from the pressing line 129 through the port 125 into the middle portion of the bored chamber 122, thence into the main pressing cylinder 16 by way of the passage 124. The main pressing piston 18 now moves upward under the influence of this pressure fluid, adding its pressing effect to the pressing effect already exerted by the auxiliary pressing pistons 19. The platen thus continues to rise and still further compress the cotton under the influence of all three pressing cylinders. When the pressing pressure has reached a predetermined maximum, the servo-motor valve unit 152 causes the shifter ring of the main pressing pump 3 to move to its neutral or zero-discharge position under the influence of the piston rod 157, changing the position of the fulcrum 156 (Fig. 1). The main pressing pump 3, therefore, continues to hold the pressure in the pressing cylinders 16 and 17, but not to increase it.

The door-operating valve unit 5 is now operated in the reverse direction, the valve rods 75 and 76 being moved downward. This causes pressure fluid to flow from the door-operating pump 4 through the line 81 and the middle chambers of the valve casings 67 and 74 through the pipes 64 and 70 respectively to the space behind the piston heads 32 and 55 respectively. Under the influence of this pressure fluid, the piston heads 55 move away from one another carrying with them the end doors 58, and thus removing the recesses 61 thereof from their engagement with the ridged portions of the side doors 25. The latter are then free to move downward, and do so under the influence of the pressure fluid acting behind the piston head 32, causing it to move upward and hence moving the side doors 25 downward through the intermediate action of the links 29 and the arms 28 operatively connected thereto. The fluid displaced from the outer chambers of the cylinders 52 and 53 flows back to the fluid tanks 2 by way of the pipe 71, the upper chamber of the valve casing 74, the port 87, the branch pipe 89 and the return pipe 86 (Figure 2). Similarly, the fluid displaced from the upper chamber of the cylinder 33 returns to the fluid tank 2 by way of the pipe 63, the upper chamber of the valve casing 67, the port 83, the branch pipe 85 and the return pipe 86.

With the doors thus open, the press operators then tie the bale securely by the binding members in the slots 21 of the platen 20 and the press head 13 respectively, and then sew the bale while it is still in the press.

After the bale is properly tied and sewed, the servo-motor air control valve 8 is reversed, thereby shifting the movable shift ring of the pressing pump 3 and reversing its flow. The pull-back line 135 now delivers the pressure fluid and the pressing line 129 serves as the return line.

At this stage the main cylinder relief and by-pass valve 6 comes into operation. While the pressing pump 3 is operating the press in the pressing stroke, as previously described, the pressure fluid from the pressing line 129 backs up through the pipe 133 into the middle portion of the bored chamber 163 (Figure 6), where it acts equally on the inner surfaces of the piston heads 166 and 167, hence fails to move them in either direction. The pressure fluid accordingly passes onward into the lower portion of the bored chamber 164 where it acts against the lower surface of the piston head 178 to force the piston rod 177 upward in opposition to the force of the compression coil spring 182. As it moves upward, the lower piston head 178 on the piston rod 177 fails to uncover any escape passages; accordingly the pressure fluid is confined within the chambers previously mentioned.

At the instant the main pressing pump 3 is reversed, however, the pressure fluid now flows into

the upper portion of the bored chamber 163 (Figure 6) from the pipe 138, and acts against the upper surface of the piston head 166, forcing the latter downward and uncovering the passage 176 leading into the middle portion of the bored chamber 164. The same downward motion of the piston rod 165 causes the piston head 167 to uncover the annular chamber 200. Meanwhile the piston rod 177 is held in its upper position by the pressure fluid under the piston head 178, causing the piston head 179 to uncover the exhaust passage 188.

Under these circumstances, the pressure fluid from the main cylinder flows through the bored chamber 163 into the enlarged chamber 200 and through the passages 201 and 191 into the tank 2. Meanwhile the discharge of the pressing pump 3 into the pull-back line 135 has been carried backward through the line 138 into the portion of the bored chamber 163 above the piston head 166 (Figure 6), thence through the transverse passage 176 and the bored chamber 164 out through the exhaust port 188 into the tank 2.

Thus the action of the main cylinder relief and by-pass valve, as above described, causes the pressure in the main cylinder 16 to be relieved at the moment of the reversal of the pressing pump 3, and also causes the discharge of the latter pump to be temporarily by-passed through this valve into the fluid tank 2. When the pressure in the main cylinder 16 has been relieved to such an extent that the pressure fluid coming therefrom by way of the pipe line 133 into the lower portion of the bored chamber 164 is insufficient to overcome the downward force of the coil spring 182, the piston rod 177 moves into the position shown in Figure 6, covering the exhaust port 188 and preventing the further escape of fluid from the pull-back line 138 through the transverse passage 176. The piston head 166 remains in its downward position under the influence of the pressure in the pull-back line, but the pressure fluid thereof acts equally on the inner portions of the piston heads 178 and 179 and, therefore, fails to move the piston rod 177 in either direction. Fluid is still free to escape, however, from the main cylinder pipe line 133 through the bored chamber 163 and its annular enlargement 200 by way of the longitudinal conduit 201 into the exhaust port 191 and thence to the fluid tank 2.

At the same time the dropping of pressure in the main cylinder 16 and a consequent dropping of pressure in the pressing line 129 (Figure 2) causes the pressure likewise to drop in the chamber 141 of the surge valve 7, until it is insufficient to resist the force of the coil spring 148, whereupon the piston head 146 moves to the left, and cuts off communication between the chambers 141 and 142. At the same time the pressure of the fluid from the pressure line 135 in the end of the chamber 122 forces the piston head 150 backwards, covering the port 125 and uncovering the port 123. The fluid discharged from the main cylinder during the pull-back operation is then free to pass through the pipe line 127 back into the fluid tank 2, whereas that from the auxiliary cylinders 17 passes through the pipe line 129 into the pressing pump 3, whence it is discharged under pressure through the pipe line 135 into the upper portion of the auxiliary cylinders 17 behind the pistons 19 thereof. Meanwhile the fluid trapped in the chamber 143 is expelled through the branch pipe 210 and the check valve 211 into the chamber 141.

The highly compressed bale is now removed from the press and replaced by another bale, whereupon the above cycle of operations is repeated.

The suction relief valve 9 operates to open when the pressing pump 3 is performing the pressing operation, withdrawing additional fluid through it from the tank 2. This additional fluid is needed to fill the main cylinder 16 when the line 138 is the suction line and the line 129 is the pressure line.

It will be understood that I desire to comprehend within my invention such modifications as may be necessary to adapt it to varying conditions and uses.

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

1. A hydraulic compress comprising a stationary press head, a platen movable toward said press head, a main hydraulic piston and an auxiliary hydraulic piston connected to said platen, means for supplying pressure fluid initially to said auxiliary hydraulic piston until a predetermined pressure is reached thereat, means for thereafter supplying pressure fluid to said main hydraulic piston and said auxiliary hydraulic piston simultaneously, means for enclosing the space between said movable platen and said stationary head on all sides, said enclosing means comprising side and end doors hydraulically movable into closed positions, a hydraulic motor for closing said end doors, and another hydraulic motor for closing said side doors.

2. A hydraulic compress comprising a stationary press head, a movable platen, a pair of oppositely disposed horizontally pivoting side doors, a pair of oppositely disposed reciprocating end doors, a hydraulic motor to close said pivoting doors, another hydraulic motor to close said reciprocating doors, and means adapted to cause one set of said doors to move into closed position before the closing of the other set thereof.

3. A hydraulic compress comprising a stationary press head, a movable platen, a pair of oppositely disposed pivoting doors, a hydraulic motor to close said pivoting doors, a pair of oppositely disposed reciprocating doors, a hydraulic motor to close said reciprocating doors, and means adapted to prevent the motion of one set of doors until the other set of doors has moved into its closed position.

4. A hydraulic compress comprising a stationary press head, a hydraulically movable platen, reciprocable end closure members for said compress, hydraulic rams for reciprocating said end closure members, horizontally pivoted side closure members, and a hydraulic motor for closing said side closure members.

5. A hydraulic compress comprising a stationary press head, a hydraulically movable platen, reciprocable end closure members for said compress, horizontally reciprocable hydraulic rams for closing said end closure members, said end closure members being mounted upon said rams and reciprocable therewith, side closure members being pivotally movable on horizontal axes into their closed positions, and a hydraulic motor for closing said side closure members.

6. A hydraulic compress comprising a stationary press head, a hydraulically movable platen, a pair of oppositely disposed reciprocable end closure members for said compress, a pair of hydraulic rams for reciprocating said end closure members, side closure members pivotally movable on horizontal axes into their closed positions, and

a hydraulic motor for closing said side closure members.

7. A hydraulic compress comprising a stationary press head, a platen movable upwardly by hydraulic means toward said stationary head, means comprising a pair of horizontally reciprocating doors, and a pair of horizontally pivoting doors engaging one another for inclosing the compressed material on all of its lateral sides between said platen and said stationary head during the pressing operation, oppositely moving hydraulic rams for closing said reciprocating doors, and a separate hydraulic motor for closing said pivoting doors.

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